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Spectrum Capman and Paint
CBM 64 sprite editor
BBC Rocket Screen
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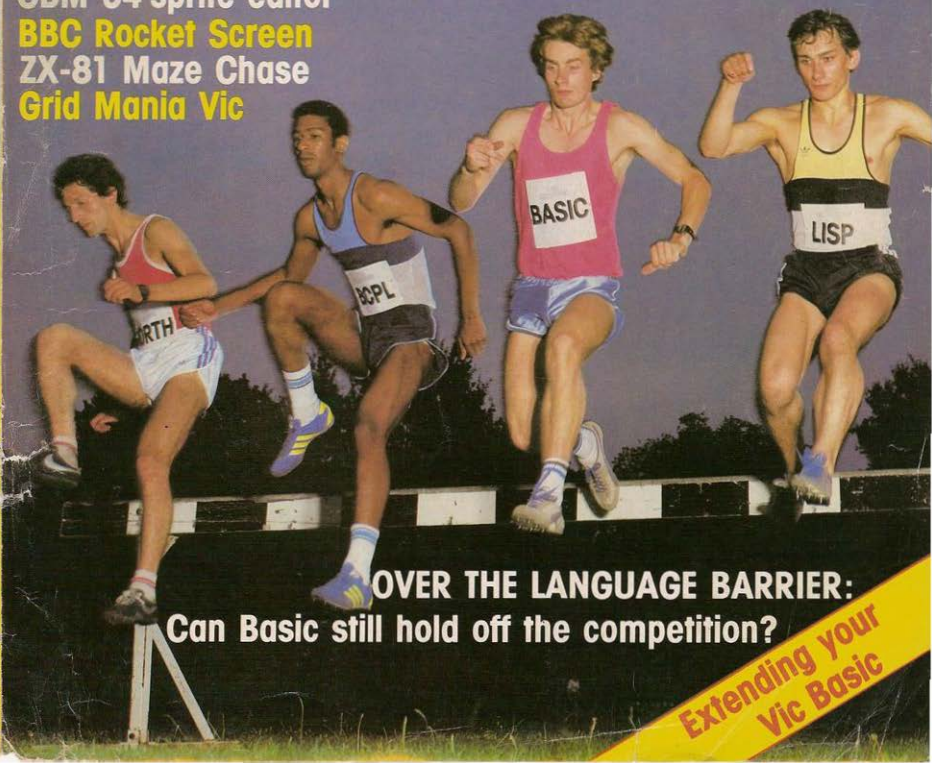

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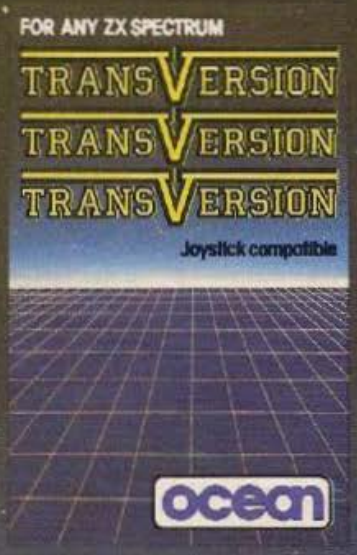

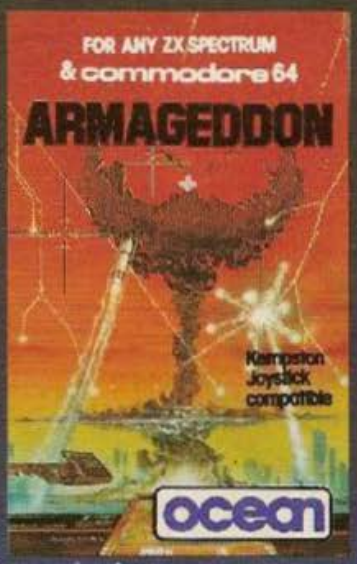

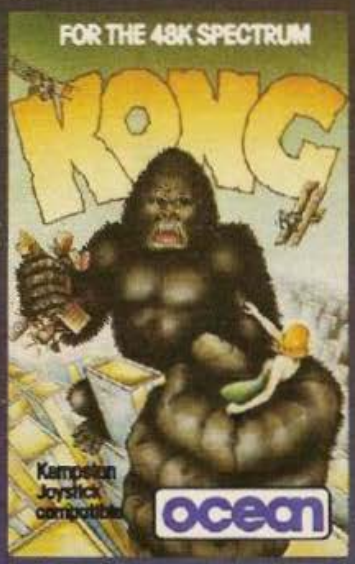

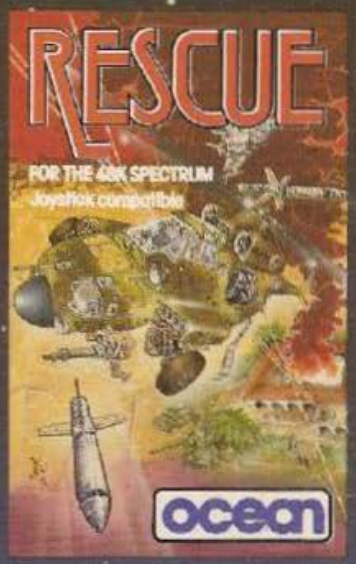

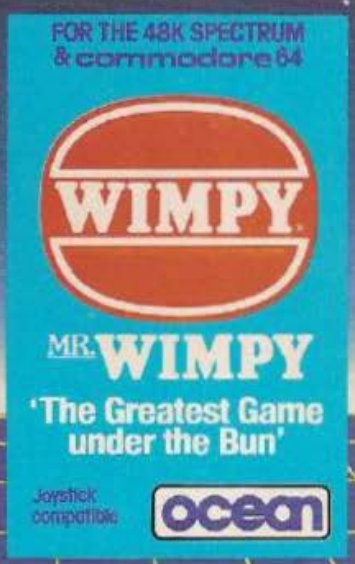

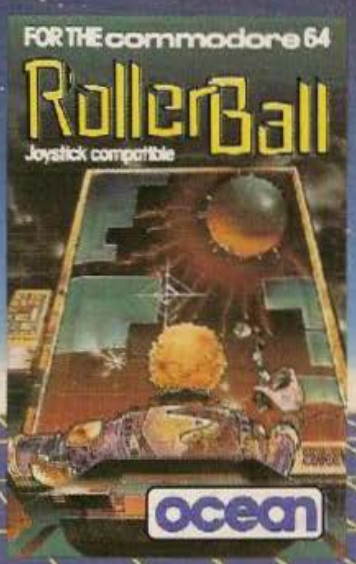

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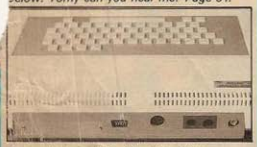

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46 **EDITORIAL AND YOUR LETTERS:** Dusting down the old Atom, getting things into Sharp perspective. Computing: why it's different for girls.

48 **NEWS:** Elan £200 micro with built-in word processor and 64K RAM; Sinclair's flat-screen TV at last; Smiths' window for cabling computers together.

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57 **COMPUTER CLUB:** Paul Bond pokes around the Peak District.

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72 **ORIC SOFTWARE:** Pete Connor pings and zaps his way through the exciting world of software developed for Britain's loudest micro.

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95 **ATARI BATS:** Whoever he is behind that mask of his, Stan Ockers is all set to slide down the bat-pole and show us round the bat-cave.

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169 **MODEMS:** John Dawson tries the Maplin Modem.

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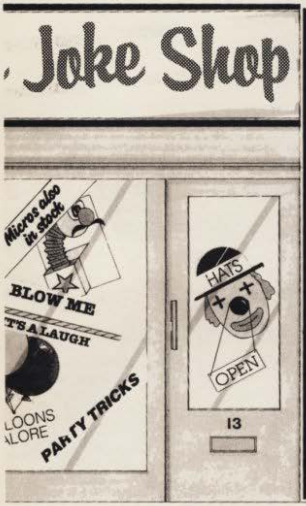

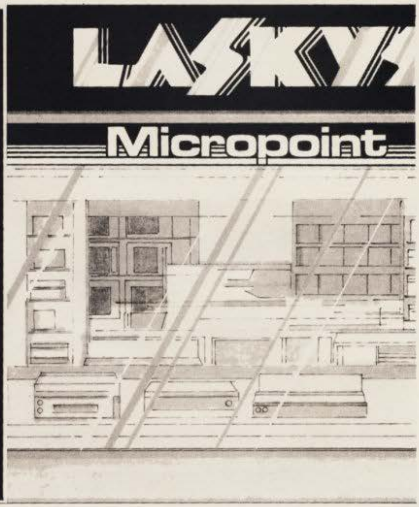

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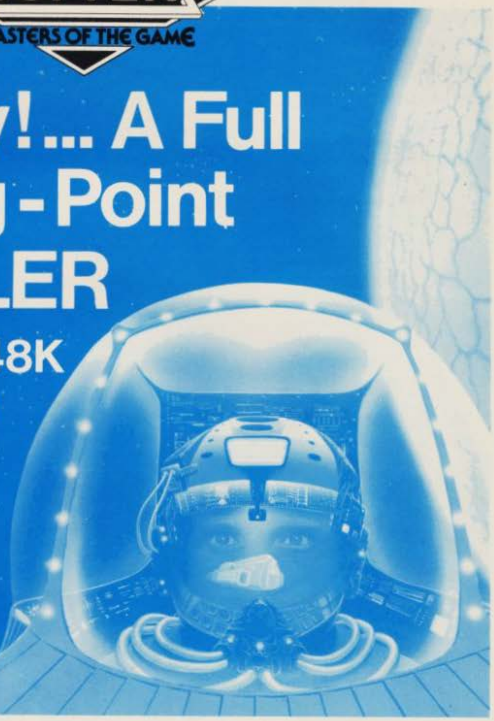

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4

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Welcome to another Sinclair Special. Even if you're not yet a Sinclair owner; I believe you'll find something of interest in this latest issue.

For instance, if you're looking for the best way to begin computing, turn to our back page. You'll see that leading Sinclair retailers are now offering the popular ZX81, complete with a 16K RAM Pack *and* a free software cassette, all for £45. That means savings of at least £29 on one of the world's all-time best-selling computers.

Those same retailers are also offering the ZX Printer at its regular price of £39.95, but accompanied by a *free* 5-roll Paper Pack, worth £11.95.

If you want to add even more speed and versatility to your ZX Spectrum system, you'll be pleased to hear that the new ZX Microdrive has now been officially announced.

Microdrives are being released on an order of priority basis. Spectrum owners who purchased direct from us will be sent order forms, in a series of mailings that begin with the earliest names on our list of Spectrum owners. If you didn't buy direct from us by mail order, send us your name and address (use the coupon in this Sinclair Special). We'll add your name to the list, and send you a colour brochure and details on how to order.

Finally, if you're looking for more ways to use your ZX system, take a look at the software opposite. There are programs for programmers, a space-chase and car race for arcade-game players, a brand new logic game for those who've exhausted 'the cube.'

The Cattell IQ Test is based on the definitive professional psychologists' test – and forms an accurate but easy way of measuring your own IQ. All the new programs are available direct from us, through the order form in this issue.

You'll see what I mean about Sinclair having something for everyone. And we'll have even more to show you at two forthcoming exhibitions: the PCW Show at the Barbican Centre, from September 28th to October 2nd, and the Great Home Entertainment Spectacular at Olympia, from September 17th to 25th.

Nigel Searle

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	ZX Spectrum – 16K	3002	99.95	
	Postage and packing	0029	4.95	
			TOTAL £	

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Why the BBC Micro? It might be fairer to let someone else answer that question.

"The BBC Microcomputers are the limousines of home computers. The graphics are probably the best of any machine in this class. You are paying for a smart machine which would not disgrace the home of a professional."
Video World, Feb. '83.

"Its design has given the BBC Micro an unrivalled potential for business, educational and serious home applications. It has been equipped to function as the heart of a system which can be expanded to suit its owner's need."
Which Micro & Software Review, Feb. '83.

"The most attractive and exciting feature of the BBC Microcomputer is its enormous potential for expansion which will allow a highly expansive system to be built-up."
Deborah Carruthers, Which Micro, June '82.

"They (the graphics) are tremendously exciting, and they are one of the features that make this machine stand out head and shoulders above everything else that is available in the market place at this time."
Dave Futcher, Educational Computing, May '82.

"It is expandable and has a powerful BASIC. It has superb sound and graphics, the software is readily available and the price is right."
Mr. A. D. Alles, a BBC Micro owner from Hampshire.

"The basics are easy to follow. My wife has developed a program for teaching our daughter French vocabulary. Our daughter uses it mainly for games and simple programming."
Dr. A. Yarwood, a BBC Micro owner from Co. Durham.

"It is a very powerful computer. My husband has written his own data base. I have been writing programs and programming games. Even the children have written small programs."
Mrs. A. M. Thomas, a BBC Micro owner from Devon.

"No other computer can offer such ease of use when dealing with complex sound effects."
Which Micro, June '82.

"It isn't often a journalist can sit down to write about a computer with the certain knowledge that he has never seen a nicer machine."
Guy Kewney, Personal Computer World, Dec. '82.

"It has got huge potential. Besides playing the games, the whole family are learning basic programming."
Mr. P. S. Green, a BBC Micro owner from Staffordshire.

"Everything possible seems to have been done to ensure that this is not a 'dead end' machine..."
Paul Beverley, Personal Computer World, July '82.

Perhaps we could just add that the BBC Micro is the machine which was chosen to be at the heart of the BBC's massive Computer Literacy Project.

It is also the machine which, having won the Department of Industry's blessing, will account for over 80% of the computers bought by British schools this year.

And now for some facts about the machine itself.

The BBC Micro is light, compact and, with a conventional electric typewriter keyboard, easy to get the feel of.

It can be loaded from virtually any cassette recorder. And there is a wealth of ready-made programs available covering games, education and business subjects.

The BBC Micro uses BBC BASIC, a sophisticated version of the most popular computer language.

However, as your confidence and fluency grow, it can be adapted to switch to other languages.

It can also become a word processor, with the facility to link with a second processor for high-powered business use.

A disc drive unit can also be added. And with an adaptor, the BBC Micro is the first micro to be able to pick up programs from the Micronet–Prestel system. Another adaptor converts your TV into a Teletext receiver, with further ability to download programs.

All this for only £399.

The most sophisticated version of the BBC Micro, the Model B, is only £399. The basic Model A is £299. (Both come with a "Welcome cassette" and comprehensive introductory manual.)

They are both available from John Lewis, selected branches of Boots or local stockists.

Alternatively, if you would like to order a BBC Micro B with your credit card, or if you want the address of your nearest stockist, just phone 01-200 0200.

Or, you can buy a Model B by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants.

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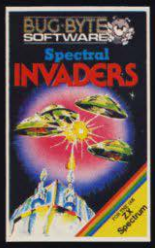

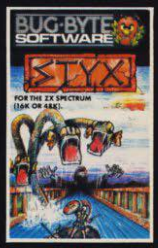

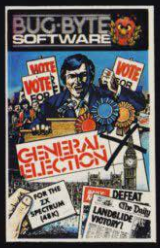

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DUNGEONS OF DOOM by Simon Mansfield. Machine: ZX81/16K/ Spectrum 48K
COBUS MAZE by Dave Gibson. Machine: VIC20 unexpanded joystick or keyboard
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On the **ZX81** you can create assembly language source tapes and assemble them into machine code using **AM-ZXEDIT** and **AMAZON**, running under the control of AM-ZXMON. AMAZON can assemble programs of up to 6K in size at one time, and accepts user symbols, hex., decimal, and string constants, and the full Zilog mnemonics.

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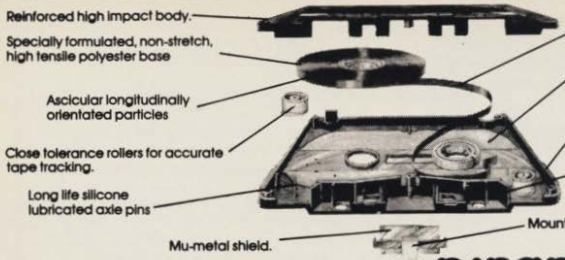

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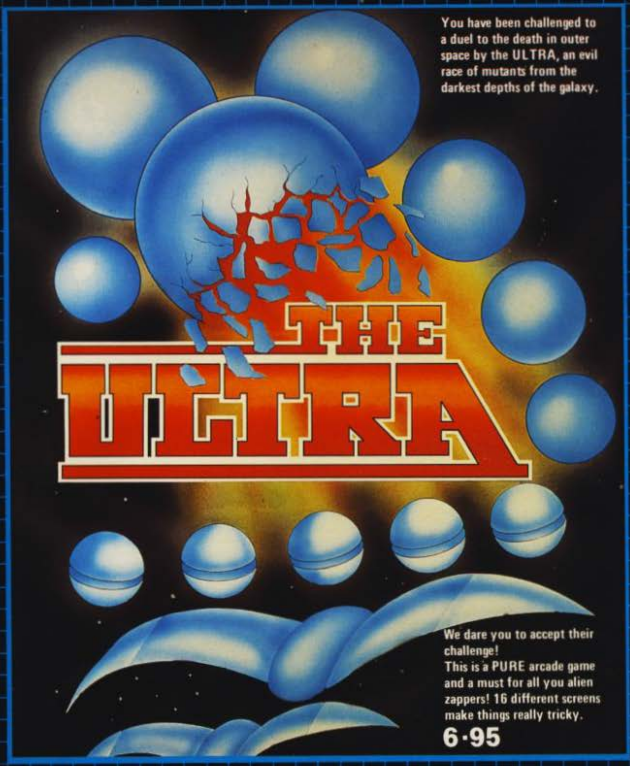

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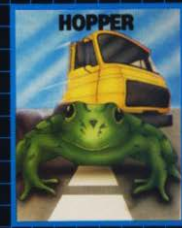

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But that's not all. Most children will feel at home with the Electron as soon as they lay hands on it.

This is because it has developed out of the Micro that has been chosen by over 80% of schools participating in the Government's current Micros In Schools project. It has a similar keyboard and has most of the functions of this much acclaimed (but naturally, more expensive) machine.

So now children will be able to continue their computer studies at home. They'll be able to use the same educational programs they use at school. And, if asked nicely, they'll be able to help willing adults take their first steps into computing.

All this for only £199.

<u>A micro technology break-through.</u>

And now a few reasons for adults why the Electron is such an exceptional machine at the price.

The Electron is neat and compact. Yet it is fast and powerful. (Full details, for the technically minded, are in the box opposite.)

It produces high quality sound using its own internal speaker.

And it offers a range of facilities many larger more expensive machines just cannot match.

For example the Electron's colour graphics have the highest resolution of any home computer.

This is because the chip that controls the graphics, specially designed by Acorn, is one of the most advanced of its kind. As a result, the Electron delivers twice as many characters across the screen as its closest competitor.

<u>Built to last and to grow.</u>

The Electron has been designed and built to be a permanent part of the family, year in year out.

Particular care has been paid to the keyboard. It is electric typewriter style: robustly constructed with a good, solid 'feel'. It has a space bar, and single entry keys for key commands.

In other words it's comfortable and easy to use, avoiding the need for the manual gymnastics sometimes associated with calculator style keyboards.

And it will grow with you via expansion modules, that Acorn are developing, to take peripheral additions such as printers and disc drives. So as your knowledge, interest and ambitions develop, the Electron can develop with you.

Additionally, to give you all the support you'll need to generate your own applications software, we've established a phone-in service attended by specialists to give advice, encouragement and practical help.

<u>A gentle teacher.</u>

The Electron plugs straight into virtually any TV set and cassette player so you will be

ready to go as soon as you get it home.

It comes not only with a comprehensive user guide, which describes the machine and its functions, but also with a book that takes you step by step through the basic principles of programming.

EXPERTS LIKE 'WHAT MICRO?' AND I RATE THE ELECTRON HIGHER THAN ANY OF THE COMPETITION.

A free taste of its versatility.

You will also receive an "Introductory" cassette which will put the Electron through its paces showing you a little of what it can do with its 64k of memory (32k ROM, 32k RAM). The cassette will give you a taste of those exceptional colour graphics we mentioned earlier; of its ability to play and notate music, and show you how it might help in home accounting. It will challenge you to a few games and will, if you ask it, do your whole family's biorhythms in a matter of seconds.

You will in short, through the 15 separate programs it contains, get a glimpse of the Electron's potential. But only a glimpse, for that potential is as limitless as your own interest and imagination.

A widening range of software.

To help you realise some of that potential, Electron software already ranges from "Personal Money Management" through "Starship Command" to "Creative Graphics" (which, incidentally, includes some spectacular three-dimensional rotating shapes). Naturally, with its strong educational links, educational software will be extremely important for the Electron and even now O and A Level revision papers are being processed for Electron users.

How to get your Electron.

The Electron is available from selected W H Smith and local Acorn stockists. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-200 0200.

Technical Specifications

Hardware.
2MHz 6502.
32K ROM 32K RAM (64K total).
High resolution graphics 640 x 256 max.
Seven display modes.
8 colours and 8 flashing colours.
1200 baud CUTS tape interface with motor control.
Expansion bus for add-on interface modules.
Internal loudspeaker.
PAL UHF output to colour or black and white domestic TV.
RGB output for colour monitor.
56 key full travel QWERTY keyboard with spacebar.

Software.
BBC BASIC.
Extensions include interger, floating point and string variables, multi dimensional arrays: IF ... THEN ... ELSE, REPEAT ... UNTIL, procedures with local variables.
Operating system allows plot, draw and fill commands.
Event timing.
Built-in assembler.
6502 assembly language can be mixed with BASIC.

The Acorn Electron.

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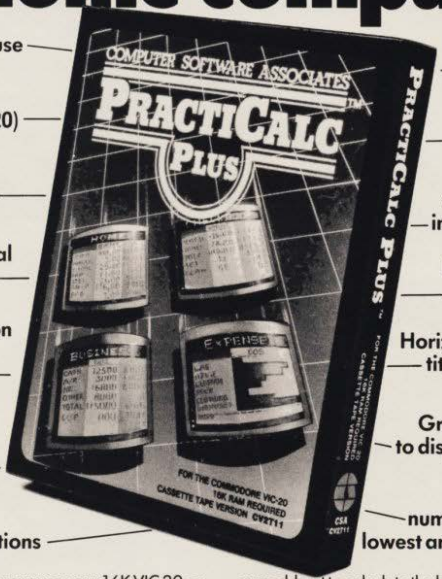

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The computer (either 80/81 or Spectrum), fits compactly inside.
You will have to remove the computer from it's original case, it is then screwed to the base of the case. The case has all the bosses already fitted and the screw holes are marked. Also fitted inside the case is a mother board (81 model only) which allows 16K, 32K and 64K to be fitted in the case. All connectors are at the rear of the case i.e. Power, Mic, Ear, T.V. and the expansion part. The case is large enough for other add-ons also to be fitted inside. One of these could be the power supply then you could very quickly fit a mains switch or a switch on the 9V line. This means you have a very smart contained unit.This case does not stop you from using any other add-ons that you may have eg Printer etc. We are convinced that this is the best keyboard available at present. It offers more keys and features than any other keyboard in it's price range.

NOTE...

The case can be purchased separately with the keyboard aperture uncut, therefore if you possess one of our early uncased keyboards, or in fact, any other suppliers' keyboards these could be fitted. The keyboard is connected to your computer by a ribbon cable and this has connectors fitted which simply push into the Sinclair connectors. It is a simple two minute task and requires no electronic skills. This keyboard does not need any soldering. Please specify on order whether you require the ZX81 or Spectrum case.

SPECTRUM MODEL

This is supplied with Spectrum legends, and a slightly different base for fitting the Spectrum inside, again, all the connectors are at the rear of the case and there is plenty of room for the power supply (and other add-ons). Should you wish to change, we can supply both the Spectrum legends and details of updating your case which will enable modification from the ZX81 to Spectrum. PLEASE specify on your order whether you require the ZX81 or Spectrum inside.

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SPECTRUM/81 TOOLKIT BOTH AT ONLY £6.95

This is the toolkit which won acclaim in the feature in the August 1982 issue of Sinclair User. "It is the most impressive programm, fast in execution with clear and full instructions . . . . it stands out from the rest of the field". The ZXED is a powerful editor for use on the expanded ZX81. It is intended for use by the serious BASIC programmer and offers several useful and time saving features most helpful during all stages of program development. The facilities provided are as follows: ALTER, BYTES, COPY, DELETE, FIND, HELP, INSERT, KEEP, MOVE, RENUMBER, AND VERIFY.

The Spectrum Toolkit contains most of the features above plus autoline numberer and append, and will run in the 16K and 48K Spectrum.

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This module unlike most other accessories fits neatly inside your computer under the keyboard. The module come ready built fully tested and complete with a 4K graphic ROM.This will give you an unbelieveable number of extra pre-programmed graphics. This now turns the 81 into a very powerful computer with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders, graphics and that only accounts for about 50 of them, there are still approximately 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there, it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K/RAM and can be used for user definable graphics so you can create your own custom character sets.

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You can also use the machine code on it's own in your own programs, for selecting out of a menu etc. The software provided will return with the X,Y, cords for it's position on the screen.

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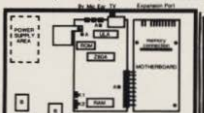

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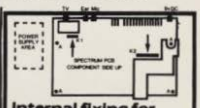

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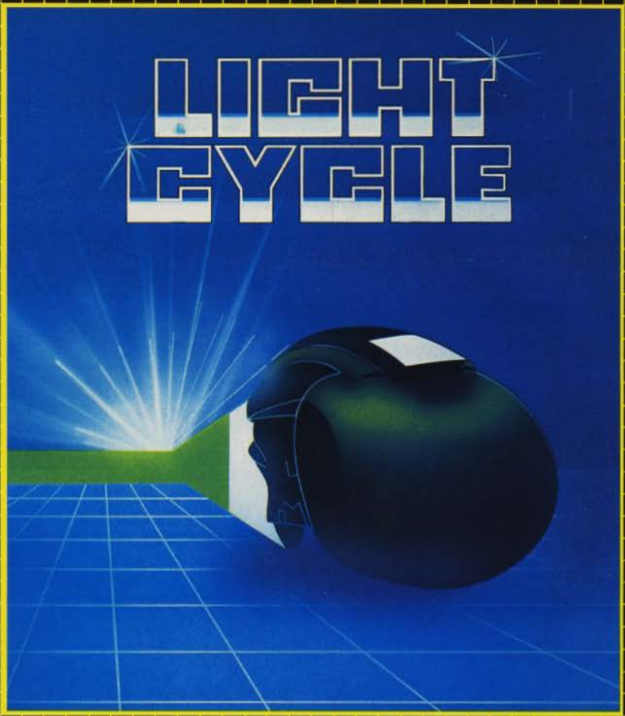

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POPULAR COMP[illegible]

"I am writing to co[illegible] 'Hobbit'. I think it is one of [illegible] ingenious programs I have [illegible] to use. It has kept me stum[illegible] months. I think the effort th[illegible] has go[illegible] writing a program like this must have be[illegible] enormous. The effects are brilliant to say th[illegible] least."

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COMPUTER [illegible]

[illegible]isty Mountains [illegible]e, this game is [illegible]eat to play and is No. 1 for [illegible] and excitement."

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CHRISTINE VERCHILD, Wilts

"One new Adventure game stands head and shoulders above the rest. It alone almost provides you with a good enough reason to buy a 48K Sinclair Spectrum. Not only does The Hobbit produce drawings of the main scenes, but it also understands proper sentences rather than pairs of words for its commands. It comes with a copy of J.R.R. Tolkien's classic book of the same name. It is the program with the most detailed and best written documentation ever."

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"I have recently purchased your excellent adventure game 'The Hobbit'. This g[illegible] greatly enhanced by the use of [illegible] graphics, its availability in [illegible] original[illegible] of having [illegible]ly to [illegible]

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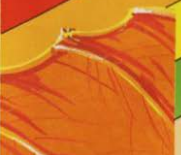

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ZX COMPUTING

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"The use of graphics is one of the features which makes The Hobbit special. The addition of graphics as good as these adds a whole new dimension to the Adventure. It is certainly a marvellous game, which should set the standard for future Spectrum adventures."

ZX COMPUTING

"**'The Hobbit' is a beautifully constructed, frantically-maddening, tortuous, gloriously inconsistent, thoroughly spooky adventure – far better than I could have hoped for and certainly the finest of the dozen or so adventure programs I have. In short, I congratulate the four who sweated for a year and a half to concoct such a super result.**"

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POPULAR COMPUTING WEEKLY

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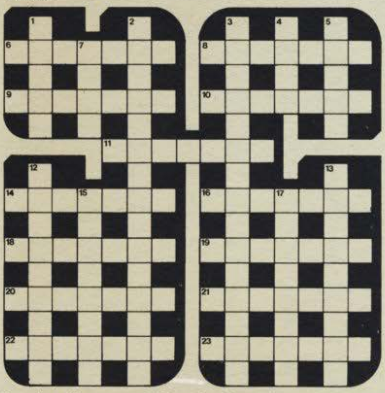

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_____ "

Your Computer **Atari competition**

ACROSS

6 The twelve-inch method for making a path (7)
8 A god and a girl with a box? (7)
9 Delay return? (3, 4)
10 Touching of the lips is king's ruin (7)
11 Aerial tribute for an insect, dead (3-4)
14 Love the artist in Pete to run the computer (7)
16 Sh! One in warp vessel with arms (7)
18 It's a man in bad shape but with staying power! (7)
19 Yes — quickly blew me round the stadium! (7)
20 Wrong identification: quick — answer back in mime! (7)
21 Dispirit because it was pressed wrong? (7)
22 The sound of driving off for the blacksmith's job (7)
23 Attach rod in contact with the top (5, 2)

DOWN

1 Bug so difficult to find leads to a subroutine (5)
2 Electronic brain with a scheming nature (11, 4)
3 Rudimentary sentences may be started by 1 down, 5 down, 13 down, etc (5, 10)
4 Totals a tuppenny's worth (4)
5 Display in capitals (5)
7 Stops in PRINT ABS (X-Y) (4)
12 See the delicate and brilliant circle (9)
13 Basic array creator of some size (9)
15 Memento concerning the bodyguard (8)
17 Take away the bus going up over an area (8)

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ADVANCED SOFTWARE

ATOMS LEFT BY THE WAYSIDE

Ten months ago I purchased an Acorn Atom. After many weeks of careful thought about which computers were available on the market I was sure I had made the right choice. I felt that I had bought the ideal instructional and games computer to use with my family and for myself.

Alas it is becoming increasingly more apparent to me that Atom owners have been left by the wayside by Acornsoft and the numerous software companies, in favour of the newer more popular computers.

When I purchased my Atom, it was quite popular with many programmers and much software was available.

Nowadays there is hardly anything advertised for my computer. I am really sickened at having parted with £200-plus for what is now a piece of hardware not catered for by programmers.

What I am wondering, is how long will it be before Spectrum and Model B owners find themselves in the same boat as myself?

All I ask is that the programmers and manufacturers think of the computers that have been on the market, every once in a while.

Also how about, *Your Computer*, publishing an up-to-date list — maybe only once a quarter — of software currently available for the various machines and, "has-been" machines, along with contact addresses of where we can purchase the software.

M Schofield, Fareham, Hampshire.

SHARP TONGUE

I am one of those fairly rare owners of a Sharp MZ-80B computer. It serves my purposes very well, with only a few shortcomings, not the least of which is Sharp itself.

So, I read the July review of the "new" MZ-700 with some interest. This has been available since last summer in Japan, where it has sold quite well. It lacks competition from BBC and CBM 64 machines but patriotism doubtless aids the success of Japanese computers in Japan. But then so does reliability. I am sure the MZ-700 will work without any problems, like my 80B and probably all the As and Ks around the world. Its well-made looks will strengthen one's confidence. Still, the average buyer here is spoilt on bells, whistles and lights, which are main features of several native micros. That is why the MZ-700 will not appear innovative.

My sole impression on seeing it last January in an Osaka store was of a sawn-off MZ-80A with colour. It struck me as about 12 months late. In those 12 months, how many loyal Sharp owners have foresaken their solid old Ks, As and Bs for smarter, flashier temptresses? They are unlikely to return, contrite. Meanwhile, what has Sharp been up to?

Well, not supporting its product fully. There is some difference between the parent organisation and its overseas subsidiaries. Sharp Japan sells customised desks for its systems as well various little extras. Also, smaller companies supply a fair range of add-ons, software and languages. For example, I saw, among other things, a 320K RAM card for the MZ-80B, joysticks and colour cards for all the models, and even a 68000 cross-assembler.

In Britain, Sharp users are left largely unware of such things. The MZ-700 in Japan has two Basics: the fast but limited Sharp Basic and a full and versatile Microsoft Basic from the Hudson Company of Sapporo. Sadly, it seems that the latter — perhaps for copyright reasons — has not survived the trip. However, how much better these very worthy computers would have sold here if there had been similar support?

Perhaps Sharp, with the 700, is making a slow and graceful withdrawal from a too competitive personal computer market in the U.K. The introduction of the MZ-700 this year instead of last may not be a good portent for us remaining Sharp owners.

Martin D Winbow, Reading, Berkshire.

FILES HEADACHE

A few months ago I was lucky enough to discover a copy of *Your Computer* at my local newsagents and I have not missed any of its monthly issues ever since. I greatly appreciate the stress on serious applications — preferably those in machine code — instead of the usual ready-to-type-in games.

What gave me a bit of a headache was Kevin Hill's Tape Files program until I found out that Mr Hill seems to be using a ZX-81 with an old ROM. So, for all your readers who purchased their models after the end of 1981 here is what can be done about it.

Load the program following the instructions given in the article, wait for the message

M/C LOADED

to appear and then quickly break the program. Now change all calls to Slow, Fast and Test For Break by adding three bytes to the addresses given in the listing. This can be done by a few simple Pokes:

Location: 31700 – 43 (decimal)
31898 – 43
32048 – 43
32060 – 35
32351 – 70

Run and Save the program as before and there should be no more obstacles between you and the *Encyclopaedia Britannica*. You could, of course, speed up the Loading and Saving by using a modified version of Trevor Hill's loader program from the March '83 issue of *Your Computer*:

Allow the program to load above RAMtop and execute New, then type in

```
 1 REM XXXXXXX 40 Characters for
   M/C
10 DIM M$(1087)
20 RAND USR 16514
30 SAVE "TAPE FILES"
40 RAND USR 16531
```

Use the well-known hex loader to enter the following machine code:

```
4082 2A1040 LD HL, (4010) Variables
4085 110600 LD DE, 0006
088 19      ADD HL,DE
4089        EX HL,DE
408A 21C17B LD HL,7BC1   Start of
                         code
408D 013F04 LD BC,043F   Length of
                         code
4090 EDB0   LDIR
4092 C9     RET
4093 2A1040 LD HL, (4010)
4096 110600 LD DE, 0006
4099 19     ADD HL, DE
409A 11C17B LD DE, 7BC1
409D 013F04 LD BC, 043F
40A0 EDB0   LDIR
40A2 3E7B   LD A,7B      New value
                         for RT
40A4 320540 LD (4005),A  Set RT to
                         dec 123
40A7 CDC303CALL 03C3     Call NEW
                         (ROM)
```

This will, when Run, Load the code down into M$, Save it, Load it above RAMtop, reset RAMtop to 123 and wipe out the loader program.

Hermann Kubiak, Witten, Germany.

SWAP SAVE

Users of the 16K Jupiter Ace may want to write programs for friends with 3K machines, however,

PLAYING THE 1802 OVERTURE

Following the launch of the Comx 35 and the somewhat disparaging remarks that have been levelled at its CPU — *Your Computer*, August — I feel I must climb on to my soap box and make a stand for the CDP 1802.

To start with Ms Peel refers to the 1802 as an outmoded CPU. If this is the same as old then it is no older than the Z-80.

How many CPUs have an instruction set where all instructions are either two or three machine cycles long? How many CPUs have user-definable program counters, stack pointers etc? How many CPUs have seven input and seven output lines available. How many CPUs have a single bit register that is provided intentionally for use as a tty driver?

How many CPUs can address a full 65K and jump to any address within that block on a single instruction? Backward jumps? Who needs to calculate them? If it is in a 256-byte block then just 30 xx and there you are at address xx. Finally if it is that old hat why is there one orbiting the earth in Uosat?

The Basic on the Comx is probably slow but then if you want speed you use machine code or Forth. Mind you I do wish I could find a stockist of the Comx so I could give it a try because I do not believe it can be much slower than Sharp SP 5010 Basic.

I am not associated with RCA in any way; it is just that having used SC/MP, 6800/6802, 8080, 6502, Z80 and cdp 1802-based machines, I have found the 1802 was the most predictable in its response to my commands.

As a non-games player why is every machine apparently assessed on its ability, or otherwise, to wipe aliens or frogs off the face of the globe? Of course the real answer could be that at 31, I suspect that I am an out-moded programmer. Still I do take *Your Computer* in preference to most of the others because it is readable — a major triumph these days.

Finally you probably all remember when you got your first computer how the neighbours all asked "What do you use if for?" Well at a recent county show on my local radio club stand, I got involved in a conversation with a young boy regarding computers.

He possessed a Dragon, and when I listed my machines to him, he immediately asked what games I had for them. On being told that I had only one — backgammon — he looked most shocked and asked me. "Well what on earth do you do with them then if you do not play games?" Obviously I'm getting old.

D A Haines, Bromley, Kent.

they might not like the idea of disconnecting their RAM-pack for fear of ruining the edge connecter. This problem is solved easily by typing the following:

16384 15384 (ENTER)

This will change RAMtop to 1k, so as far as your Ace is concerned you do not even have a RAMpack!

Now the Jupiter will act as if there is no RAMpack connected, so you can program the computer as if you had the standard 3K RAM.

Once you Save your program, it will Run on any Jupiter Ace by loading it as you would any other program.

M Caple,
Llanishen,
Cardiff.

COMPILING SINS

I was amazed when I saw that you were publishing a compiler for the ZX-81. I was on the verge of buying one and it was with excitement I bought August's edition. The machine-code listing was difficult, but after six hours I had it. I Saved it in under a minute using Richard Taylor's Quick Load program — from *Your Computer* June.

The compiler worked perfectly. I was very pleased about still being able to use the Inkey$ and CHR$ function of Basic, as well as the faster Plot/Unplot routine. Unlike most machine-code programs, you can break out of the program using the Break key. This can be disabled by the direct statement:

POKE 16750,112
POKE 16751,65

The articles on the compiler do not tell you that the program must end with a Stop command, or else the compiler will stop with an error message. The Break key can be made to stop the program by:

POKE 16750,178
POKE 16751,64

These values are of the address the computer will jump to when the Break key is pressed, and where obtained by using the machine-code editor of Trevor Hill in *Your Computer*, March.

Paul Houbart,
Southport,
Merseyside.

The article accompanying the ZX-81 Sea Mines program in September neglected to mention three variables which need to be assigned a value directly from the keyboard. When you have finished keying in the program enter the following statements:

LET C$ = "32 spaces"
LET O$ = "000000"
LET HSC = 1000

Some of the graphic characters in the Spectrum Balloons program have not been clearly printed. In line 480 the characters are graphics Q and graphics S, while in line 515 the character is graphics S.

EDITORIAL

NOTHING COULD BE more condescending than proposing pink computers for girls and blue ones for boys. But if such a fatuous suggestion actually led more girls into computing it might even be worth taking seriously.

Of course it is exactly that kind of pink and blue reasoning which lies at the root of the problem. While little girls are being given dolls, the guns that boys play with make the later transition to computer shoot-'em-up games easy and natural.

In general, mechanical and technological toys are for boys, and girls who take an interest in them are considered unfeminine. A clutch of recent surveys gives statistical substance to this sorry state of affairs.

Gowling's report published early this year showed that the father and son partnership makes up 80 percent of home-computer owners. Now research from Acorn rams home a similar message. In all the families that have computers you will find that boys are 13 times more likely to be using them than girls.

Because the boys are putting in the extra work at home they pull ahead in the classroom. This dampens what little enthusiasm the girls have, and makes them more likely to become discouraged and so even more likely to drop out.

Some schools have decided to take the matter into their own hands. They have gone for a form of positive discrimination by starting computing classes for girls only. This is an attempt to get away from the idea that computers are male machines.

The problem is not a peculiarly British experience either. Across the Atlantic, researchers at California's Stanford University found that three times as many boys attended computer summer camps than girls — and that is bad news, particularly as it comes from Silicon Valley itself.

If being interest in computing at school depends ultimately on catching a child's imagination at home, then creating software for the home computer to appeal to girls as well as boys will clearly be of key importance. To do that the software houses will have to produce more than just arcade shoot-'em-ups. But of course that does not rule out all games — according to Atari Pac-Man has a large following among women.

Most of the programs that have so far been written for women and girls have either been patronising or the sort of application better carried out with a pen and a piece of paper. Recipe storage or meal planners are typical.

Perhaps the real problem with this kind of software is that because it is consciously aimed at females it often blunders into the gaping trap of sexual stereotyping. After all, most commercial programs are not designed to appeal to boys exclusively, so why should the converse be necessary?

If some enterprising software companies manage to increase the proportion of female computer enthusiasts in society it would not need to be done from the highest moral principles. A lucrative software market — at least the size of the existing one — is waiting to be tapped.

Acorn's findings revealed that only four percent of home micros are used by the mother. Imagine the sort of spending power that would be unleased if that figure were improved to even 20 percent.

Although women could benefit enormously from computers, it is ironic that the female-dominated job areas are the ones most under threat from new technology. There seems little choice but to snatch the micro away from Junior and start computing before the boy-girl imbalance becomes a permanent division.

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

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Advance into IBM country with a home micro with recognised business potential

WITH 128K AND A 16-BIT processor for the price of a BBC Micro the Advance looks almost too good to be true. The Advance sets out to be a good home computer with joystick and printer ports and 16-colour high resolution but the real advantage comes if you want to upgrade to a full disc-based system when you can afford to.

For a further £850 you can upgrade to the Model B with two floppy disc drives and the capability to ran software from the IBM Personal Computer. The total cost will be £1,250 — a third of the price of an equivalent IBM PC, yet the Advance Model B is claimed to be 40 percent faster than the IBM because it has an 8086 central processor, and it will come with some of the best software available, WordStar, Mailmerge, and CalcStar included in the package.

Initially most *Your Computer* readers will be more interested in the £400 Model A. Because the keyboard is designed to compete with professional machines it is of a far higher standard than home computers are used to.

It is separate from the main circuit board which is housed in a desktop unit, although you can stow the 80-key keyboard in the unit for storage.

The Advance is being built in Britain; the case at Metal Closures in Skelmersdale, and the circuit board, final assembly, and testing at Ferranti in Oldham.

Price war hots up and NewBrain bites dust

THE FIRST CASUALTIES of the home computer price war are now being counted. Grundy Business Systems, manufacturer of the NewBrain, has gone into liquidation, while to continue production of the Dragon 32, Dragon Data has been forced to arrange a loan of £2.5 million.

Further up the market scale, Osborne who produced the first portable business computer, the Osborne 1, has also collapsed leaving debts worth £15 million. "The shake-out is now beginning" was the comment of an Apple spokesman. Apple was planning to move into the lower end of the home computer market but has now decided to hold.

Spectrum Stewart's naps beat the bookies

SEVENTEEN YEAR OLD David Stewart's horse-racing prediction program for his 48K Spectrum has a 66 per cent success rate in picking winners — certainly a higher rate than that achieved by most national tipsters.

Radio Cleveland started broadcasting David Stewart's tips earlier this year. Recently the national dailies took up the story and he is now under contract to the Sun to supply the paper's readers with three tips a day.

David says that so many punters are now backing his selections that they are influencing the odds dramatically. This is not a problem that troubles him unduly since he does not bet himself: he says he gets pleasure simply from writing programs and picking winners.

It took him two years to complete the program during which he analysed racing results over the last three years. The control program is 20K long and reads in data files which together hold the details on some 17,000 horses. The program runs for three quarters of an hour before it throws up the day's likely winners.

David Stewart is now contemplating moving his system on to the BBC Micro and is also looking into the possibility of a pools prediction program.

Elan Enterprise warps in to add a new dimension to the £200 computer market

INTELLIGENT SOFTWARE'S Elan Enterprise looks like the computer we have all been waiting for. The only problem is we will have to wait until April to find out if it is as good as it seems.

The Elan has higher resolution graphics than the BBC Micro, with a maximum of 672×512, almost 10 times as many colours as its nearest rival, 250 in all, and 58K of memory available to the user, more than on any other home computer.

As the Elan also has a built-in word processor and a price tag of just £200, it is no wonder that Intelligent Software's David Levy is confident it will sell well. "It's true the hardware is intelligent" he says; and he is quite confident that his team has not only software experience — IS has produced the best chess program on a micro, Cyrus — but also hardware "One of our engineers designed the Acorn Atom, another designed the Nascom."

The Elan has a real keyboard although the feel is not quite as good as that of the Electron or Commodore 64 and a built-in joystick which can be used either to make word processing easier or for games playing. The Elan will also be available in a 128K version, and both the 64 and 128K versions can be expanded up to 4 Megabytes of RAM using paged memory.

The Elan uses a Z-80A processor rated at 4MHz and has a 32K ROM including an ANSI-style Basic. Sound is another strength with four channels through eight octaves with a stereo option. Output is through the TV speaker but you can also plug a pair of Walkman headphones into the stereo socket in the back.

When the Elan is launched in April there will be plenty of software.

The Elan also has one cartridge and two joystick ports, RS423, Centronics and local network interfaces and can control two cassette recorders simultaneously. The keyboard has eight definable function keys.

Elan will also be selling Sony 3.5in. microfloppy disc drives which plug in to a Base Unit which can also take additional RAM modules and other peripherals. The Base Unit connects to the Elan through a 64-way connector.

While other manufacturers are working on 16-bit micros for next year the Enterprise is not boldly going where no home computers have gone before but it is offering the best of all the existing micros and a little bit more for a fraction of the price it would cost you today. Let us hope it turns out to be as good as it looks.

YOUR COMPUTER TOP 20

Game	Company	Machine
■ Arcadia	Imagine	Vic-20
■ Chess	Sinclair	ZX-81
■ Crazy Kong	Interceptor	Vic-20
■ Crazy Kong	Interceptor	CBM-64
■ Dark Crystal	Sierra Ventore	Atari
■ David's Midnight Magic	Broder-bund	CBM-64
■ Diamonds	English Software	Atari
■ Doodle Bug	Dragon Data	Dragon
■ Flight Simulator	Psion	Spectrum
■ Frogger	Microdeal	Dragon
■ Hobbit	Melbourne House	Spectrum
■ Hunchback	Superior Software	BBC
■ Manic Miner	Bug Byte	Spectrum
■ Sky Hawk	Quicksilva	Vic-20
■ Snooker	Acornsoft	BBC
■ The King	Microdeal	Dragon
■ 3D Grand	DK, tronics	ZX-81
■ Trans-am	Ultimate	Spectrum
■ Xenon	UK Software	Oric
■ Zzoom	Imagine	Spectrum

BBC, Oric and Atom learn to speak with the Microtalker

MICROS FIND a common voice with a low-cost speech synthesiser compatible with the Oric, BBC and Atom, and soon to be available for other micros, too.

The allophone-based Microtalker plugs into the BBC user port and the printer port on the Oric and the Atom. On the latter two machines it operates using standard printer commands. For the BBC a simple driver routine consisting of almost three lines of assembler is used.

Based on the VI SPO-256 speech synthesiser chip, the £40 Microtalker has built-in amplifier, volume control and speaker and can be obtained with demonstration software from RPS Electronics, Saltaire Workshops, Ashley Lane, Shipley, West Yorkshire. Telephone: 0274 588310.

Horace and Hobbit move

TWO OF THE MOST popular characters in Spectrum games are moving to other machines. Hungry Horace and The Hobbit have been Melbourne House's most popular Spectrum games but now Horace is moving on to the Dragon 32 and the Commodore 64. Meanwhile back in Middle Earth, The Hobbit, which was billed as the first intelligent adventure game when it first appeared, has moved on to the BBC Micro, Commodore 64 and Oric.

If you are trying to turn your Spectrum into a filing system you have probably already discovered that you need a controller to automatically Load and Save chunks of information. Ideally this would allow you to connect two tape recorders to the Spectrum so that a program would take raw data from one cassette and file it on a database on another cassette. The Ness Micro Systems Tape Control is designed to meet this need. The £20 controller plugs in between the cassette sockets of the computer and the output and remote sockets of one or two cassette recorders. It also doubles as a Beep amplifier for the Spectrum's sound commands.

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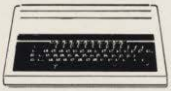

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Sir Clive joins the monochrome set — this is where the flat screen revolution starts

SIR CLIVE SINCLAIR aims to become a star of the small screen. His ambitions rest on the £80 flat-screen TV which he hopes will find its way into the pockets of the world's television-viewing public.

Although Sinclair is not the first to market a set with a two-inch screen — Sony beat him to it with the £250 Watchman — his TV is smaller, far cheaper and uses fewer components. One Ferranti chip handles most of the flat-screen's signal processing.

The six-year, £4-million project that produced the 9.5oz. black and white TV will have a major bearing on the direction Sinclair computers take in the immediate future.

The vacuum-formed tube technique developed for the TV will eventually be used in a portable micro, although Sir Clive admits that "realistically we are over a year away from that".

What has not yet been decided is whether or not a larger tube will be created especially for the computer. The alternative would be to use the TV's 4.25in. by 1.75in. by 0.75in tube and achieve a larger image by magnification or black-projection.

David Southward, Sinclair's director of research and development, sees this as the probable solution, while Sir Clive himself believes that "a bigger tube is required".

When *Your Computer* first revealed Sinclair's plans for a portable in November of last year, the artist's impressions we published showed a fold-down screen, which would be in line with the magnification or back-projection routine.

In any case if you are thinking of buying the flat-screen TV as a mini-monitor for your Spectrum, you will first have to invest in a Sherlock Holmes-type magnifying glass — letters on the screen will not be visible without one.

You will also have to open the TV up and mess around with its innards because it has no aerial socket for interfacing with a computer.

Sir Clive calls his TV "a transistor radio with a picture". Unfortunately it does not have a radio as yet. Clearly he hopes that the comparison extends beyond the TV's sixties radio like 5.5in. by 3.5in. by 1.25in. black case and into the area of unit sales.

A special flat Polaroid battery powers the TV for 15 hours. These 6V lithium batteries cost £10 for three and you should note that they push the price of the TV up to almost £90 because none are supplied with the set. Alternatively, you can plug the TV into the mains using a £8 adaptor.

Initially the TV will only be available mail-order, and production will only reach 10,000 units a month by the end of the year — so be prepared for the now industry-standard wait.

Sinclair's launch of his own Interface I for the Spectrum has not slowed the flow of plug in expansion boards from independent peripheral companies. U-Microcomputers is more used to making add-on boards for the Apple II but now it is producing a plug-in module which can take four cards offering facilities such as an RS-232 interface and control lines for anything from synthesizers to electric cookers. U-Microcomputers is on 0925 54117.

WH Smith software comes in through the back window

WH SMITH plans to get software into the home through The Window. This will not involve teams of stripey shirted young men with a jemmy in one hand and a computer cassette in the other touring every neighbourhood, because The Window is what WH Smith is calling its first venture into cable television.

The idea is that each cable operator will have 30 computer games on a machine at the broadcasting centre. People could then subscribe to a games service which would lend each house on the cable network a 64K computer which could download games from the cable. Five new games would be put on the central computer each month.

The idea comes from America and WH Smith is co-operating with a Californian company. As yet the price of the subscription has not been finalised, but in California its costs the equivalent of £5 to £10 a month.

It has been estimated that it will be 10 years before even half the households in Britain are on cable TV networks so in the meantime the more adventurous will download programs from the telephone lines via Modems while the rest of us buy cassettes or enter programs from the pages of *Your Computer*.

This is the CPD-8300 Computer Program Data Recorder, £40 from WH Smith. It features an electronic pause designed to be overridden by the computer via the remote motor control socket. There are two Input/Save sockets to ensure correct matching to computers with different level Save signals. The head azimuth position can also be adjusted.

CAMEL PRODUCTS

BLOPROM-81

```
STATUS :      NO. BYTES - HEX
              EPROM TYPE - 27128
              ROM START  ADDR - A000
              EPROM ST   ADDR - 0000
              DOB LENGTH - A000
                      ADR - CHECK

WHICH TASK DO YOU WISH TO DO ?

A) CHECK THAT EPROM IS CLEAR

B) READ   THE CONTENTS OF
          EPROM INTO RAM

C) BLOW   RAM EPROM WITH DATA
          FROM RAM

D) VERIFY THAT EPROM DATA IS
          THE SAME AS IN RAM

Q TO QUIT . . . . . R TO RESTART
- - - - - - - - - - - - - - - - - -
FAST CODES AVAILABLE
Q - R          FOR          A-F ?
```

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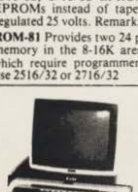

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BEGINNERS *first bytes*

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

I could do that...

If you have been doing the past couple of First Byte puzzles, you will by now have a program that can add and subtract any pair of smallish numbers. It is easy now to see how multiplication and division takes place: multiplication is just a matter of repeated addition, division is repeated subtraction.

At least, that is all that is needed for simple integer arithmetic where all the numbers included will fit into the registers. So, here is this month's task — write your own computer Arithmetic Unit!

To keep it simple you will need two Registers, 'A' and 'B', both eight bits long for the numbers to be operated upon, and a third, 'C' to hold the solution. The input numbers must not be bigger than 15 — that is, they will fit into 4 bits, so there is no problem with overflow, carries, and the like.

Then you will need to be able to input the two binary numbers into your register, specify the operator — +, -, ×, ÷ — and calculate the result. If you want a hint on how to write the addition part of the program — just look at the answer, printed below, to the puzzle from two months ago.

By and large most of the entries for August's binary addition problem took the same approach. They found that it was easiest to put the two numbers in character arrays. The first of these programs to be picked from the competition bag came from P Rutten, Kloosterstaat 47, 6824 RB Arnhem, Holland, and runs on a ZX-81.

I could do that winning program.

```
 10 INPUT A$
 20 INPUT B$
 30 LET C=0
 40 FOR N=16 TO 1 STEP -1
 50 LET A=VAL A$(N)+VAL B$(N)
 60 LET D=C AND A<>1 OR NOT CA
    ND A=1
 70 IF A<>1 THEN LET C=A/2
 80 PRINT AT 0,N;D
 90 NEXT N
100 IF C=1 THEN PRINT "OVERFLOW
```

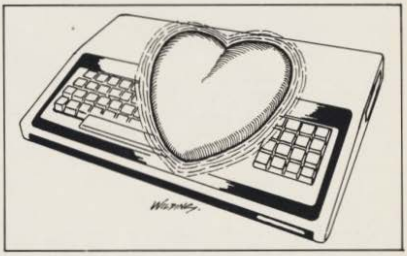
Heart of silicon

"I have got a game that will not run on my friend's computer. He says it is because our computers have got different processors. Can you explain what he means by that?

AT THE HEART OF every microcomputer is that little bit that makes the rest of the computer work. This piece is the microprocessor, and it is this that your friend is talking about. There are many different microprocessors around — see Table 1 for a few examples — and the one you have got will depend on which machine you have.

The processors are usually grouped together in families. For example the Intel 8080 series includes 8086 and 8088 processors, the Zilog Z80 series includes the Z80A and the Z80B, and the Motorola 6800 series includes the 6809 and the 68000. To say that a processor is part of a particular family means that the chip is essentially based on the parent of the series, but has minor differences.

Each processor has its own language which fits the structure inside the chip and, ultimately, it is the language which makes the chip work, and no other. The form that each processor's language takes is entirely dependent on the structure of the processor. In all microcomputers, the length of each instruction in the language for that machine is fixed. The length depends on the processor so, when a micro is quoted as being an 8 or 16 bit machine, it means that the machine code instructions are 8 or 16 bits long.



The language itself, and any programs stored in the machine, are only a series of bits that are 0 or 1 and it is not easy to program 1s and 0s only so, to help people write programs in the machines language, assemblers were invented. An assembler allows you to use mnemonics, labels and names for variables, so that you have some idea of what is going on — when the assembler Runs, it simply converts the instruction mnemonics, labels etc. into the bits and bytes it knows and loves.

It sounds, from all of this, that if you have two machines in the same column of Table 1, then you will be able to Run programs from one on the other. This is largely untrue. There are certain machine code routines that would probably Run on either, as the two machine languages are the same, but you were not allowing for the ingenuity of the manufacturers.

Even two machines made by the same manufacturer with the same chip are largely incompatible. This is often because of Input/Output, and the way that the memory is organised. If the graphics part of the memory, the screen size, or the way that information is handled are different between two machines, then programs for one, which uses any graphics or I/O, will not work properly.

It is in the interest of the industry that machines should be incompatible — it is in the user's interest that they should be the opposite. Incidentally, the choice that governs which microprocessor goes into any particular microcomputer is almost always one of cost. If Zilog for example, was to approach the maker of a new micro, and offer it half a million processors at almost cost price, then the new machine is likely to be Z80 based. Cynical, maybe, but many design decisions are taken this way.

There are attempts to thwart the deliberately incompatible industry, and one of them is the concept of the cross-assembler. This device takes a program in one machine's language and assembles it into another. Very clever, but if the destination machine's graphics, I/O etc. are different, then it is not much good.

Life without Basic

"You switch on, and you find yourself in Basic. Why?"

ALTHOUGH THIS may seem unlikely it is because Basic is really easy to use. That is, it is really easy to use compared to APL or Advanced Programming Language — the computer's Mensa. When you have done nothing more with computers than curse at them, Basic is a minefield, but you soon find it not only simple, but limiting. Then again, it all depends on the Basic. If

(continued on page 57)

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BEGINNERS *first bytes*

(continued from page 53)
you are playing around with Basic Plus 2 with extended file handling, then you are in a different league from the rest of us, and I need say no more.

Of course, what I am trying to say is that there is more to life than Basic. With the micro, as with any tool you must decide what you are going to do with it. If you are specialising in using it for list processing — family trees, databases etc. — and you are still using Basic then you need your head examined. If you are spending your time writing fast games, or anything involving fast graphics then try Forth. If you are in education then you may well be involved with Logo.

There are, however, many reasons for starting your programming days in Basic as, among other things, it is interactive, you can type:

PRINT "HELLO"

and something will happen straight away. Not much, I admit, but it is a start. If you tried typing that in MicroCobol you would probably get the computer laughing at you. This is ironic since the correct order of things is for people to laugh at MicroCobol. MicroCobol, the young relation of that tired old dinosaur Cobol, has the doubtful honour of being one of the very few programming languages redundant at birth.

However, once you have begun to master Basic, why not move onto better things? Well, until recently there simply have not been many compilers around for other programming languages. It is all very well to extol the virtues of Logo or Forth but if you have not got any way of using them on your particular machine, then you can extol until the cows come home. In fact they are both wonderful, in their own very specialist ways.

Pascal is a programmer's language, and it is my guess that most of you are not list processors but worthy programmers. If you have learnt Basic then you can almost certainly learn Pascal.

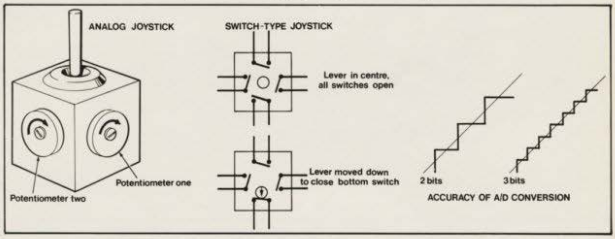
Now you have got the means to write sensible, structured, self-documenting programs, you can use your micro to do truly useful things for you. It is all very well to consider the microcomputer as some kind of multi-purpose game friend, but it has the potential of being so much more powerful than that. And of course, if you can control it, you are one step ahead before you start. Give yourself the unfair advantage, and get into Pascal. *Piers Letcher*

Choosing joysticks

Make sure you buy the right sort of joystick.

ALTHOUGH YOU CAN control your programs by pressing the keyboard people usually love joysticks as they allow them to sit back and relax as they zap the on-coming aliens.

The simplest type of joystick is just a lever which is surrounded by a ring of switches. With four switches you can only indicate North, South, East and West, but if you add more switches, more intermediate positions can be used, although of course there is a practical limit to how close together the switches can be. This means that you can only indicate a maximum of about 16 different directions. This type of joystick is used in programs in the same way as the cursor keys.



The second type of joystick uses potentiometers or variable resistors instead of switches. Two of these are placed at right angles to each other in such a way that moving North-South rotate, one potentiometer and moving East-West rotates the other. Moving in diagonal directions rotate, both potentiometers so all directions can be indicated.

These potentiometers are like the volume control on a radio and the voltage coming out of the joystick will depend upon how far round they are turned.

This variation in voltage can be smoothly continuous over a large range and therefore these are known as analogue joysticks. The CPU can only handle digital signals so this must pass through an A/D convertor which may be built into the computer — if it has a joystick port — or be in an add-on box. The system will then allow you to read the distinguished voltage value for each potentiometer. Usually 4 bits are used for each pot so you have 64 steps on both X and Y axes.

Analog joysticks can be used to indicate direction or position. First you must read the joystick value — this excert is for the Dragon.

```
10 J0 = JOYSTICK (0):
   J1 = JOYSTICK (1)
```

To indicate absolute position you can just plot X and Y co-ordinate — but remember you may have to seek the value to fit.

```
20 SET (J0, J1)
30 GOTO 10
```

To indicate directions you need to test how far the joystick is from the centre position in each direction.

```
20 IF J0 20 THEN X=X-1
30 IF JO 40 THEN X=X+1
40 IF J1 20 THEN Y=Y-1
50 IF J1 40 THEN Y=Y+1
60 SET (X,Y)
70 GOTO 10
```

You can alter the sensitivity of the joystick by changing the value tested against, the nearer they are to the centre value the more sensitive the joystick. *Keith and Steven Brain*

Analogue to digital

THE CPU CAN ONLY understand off and on so any information you want it to process must be oncerted to off/on form as binary digits or bits.

So what do you do if you want your computer to measure something like light or temperature which can vary in amount over a large range? First you must convert the light or heat into an electrical signal by means of some sort of transducer. The simplest of these will produce a voltage which changes in sympathy with the factor you want to measure. Now you must convert this voltage to binary digits with an A/D convertor.

You can think of this as a series of switches which are linked together by logic. If the voltage is zero all switches are off. When the voltage starts to rise the first switch is turned on, and then the second etc, converting the smooth analog line into a stepped digital form. The accuracy of the A/D conversion depends on how many bits are used. With two bits only four steps can be indicated.

00 both off
10 first on
01 second on
11 both on

With three bits eight steps are available.

000	110
100	011
010	101
001	111

In the same way four bits give 64 steps, eight bits 255 steps, 12 bits 2K steps and 16 bits 32K steps.

The accuracy of the conversion depends on how small the steps are. With only four steps you are only estimating to 1 part in 4 but with 16 bits you are estimating to 1 part in 32K.

Digital to analog — D/A — conversion is similar but the other way round to that sending a binary number to the D/A convertor produces a verging voltage which you could use to control something, although you would need several of these to control a power station.

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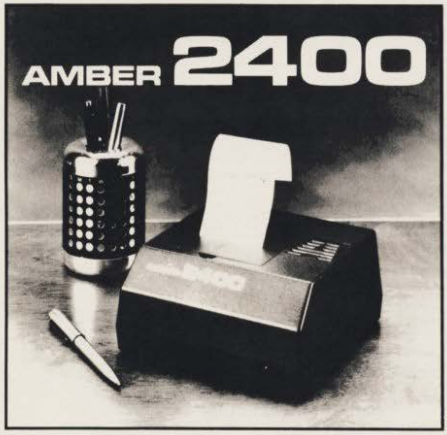

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Local news

Runcorn

The Northwest Computer Club meets every week at St Mary's Church Hall, Halton Village, Runcorn, Cheshire. For more details, contact Mike Roper on 061428 6683.

Watford

Having started out as a Commodore user group with a bias towards business users, Watford ICPUG already has a lot of BBC Micro owners in its membership, and is looking to increase its area of interest. They are to be found at Watford Co-operative Hall, in St Albans Road, Watford, on the second Monday of every month. Telephone Stephen Rabagtiati on 0923 50161 for further information.

Nailsea

The Multi-User Club has the refreshingly different idea of starting at 7.00 with the first hour reserved for youngsters. The club meets weekly, with a special topics meeting once a month. Their venue is the Toc H Hall, Silver Street, Nailsea, Avon. Contact Valerie Boyde-Shaw on 0272 851337.

Barnsley

Originally Tandy users, the Barnsley Co-operative Computer User Group now has a lot of Video Genie, Spectrum and BBC users. They meet at the Co-op Social Club, Pogmore, Barnsley, Yorkshire on the last Tuesday of every month. Contact James Bridson on 0226 41753.

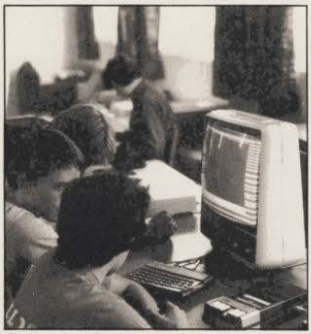
Brixham

Another club casting its net wider, the formerly Dragon-orientated Brixham Computer Users' Club meets at Computer Systems, Pump Street, Brixham, Devon every Saturday afternoon. Phone 08045 59224.

COMPUTER *club*

Paul Bond takes to the hills and discovers another sort of popular Derbyshire RAM.

KINDER PEEK



Above: loading a Spectrum game.

DERBYSHIRE AND THE Peak District embrace some of Britain's most spectacular scenery. The town of New Mills nestles peacefully in the arm of the hills — the town can even boast its own waterfall unalloyed by tourists or people making cigarette adverts. But the inhabitants of this pastoral idyll are not content to let development in the outer world pass them by. For this town is the home of people whose interest is a different kind of Peek. The New Mills and District Personal Computer Club, as the now more succinctly-named Kinder Peek Computer Club was formerly known, was formed in September 1982 and has around 100 members.

Youth is firmly at the helm, with chairman Mark Brennand, secretary Piers Longhorn, and aptly-named news-sheet editor Mark Chopping all aged 16. Neither is the club exclusively male-dominated, with 15 year-old membership secretary Amanda Potts responsible for maintaining the large file on a specially-adapted ZX-81.

Founders Martin Flanagan — who handles ACC liaison — and John Eary — who has grasped the nettle of public relations, claim the club started almost by accident, as an offshoot of their desire to raise awareness about Information Technology at school level. Martin Flanagan, wearing his school governor's hat was trying to find ways of financing the introduction of microcomputers into schools just prior to the government scheme starting. Thanks to the offices of Prestel, an exhibition in the local town hall attracted a large number of people. Names were taken to form the basis of a computer club.

The club's expansion was aided by lectures for parents held at New Mills Youth Club, which was only too ready to grant facilities. It is a sad fact that the Youth Club's own expansion was prompted by the rising tide of unemployment figures experienced under the present government. John Eary, an ex-ICL man now working as a consultant, gives courses on understanding your home computer and basic Basic.

The club's members are no slouches, either. Jonathan Hill and Sean Bond have had their program for the BBC Micro, Cowboy Maths, accepted by MEP — the Microelectronics Education Programme.

Your Computer visited the club during the throes of a fund-raising event staged in the local school. Apart from coffee and sandwiches, for a small fee of five new pence it was possible to get some hands-on experience of various computer games.

As well as events like this, the club fixes visits to computer exhibitions, club competitions and arranges displays for local organisations — for example, shows for the school's PTA at the summer fairs. Talks and demonstrations about various aspects of computing are given on club nights.

The club, which meets at New Mills School every Monday, welcomes new members whether they have their own computer or are just interested in computing. Right now they would be keen to welcome anyone in the New Mills area who would like to give talks on Z-80 machine code.

Members are encouraged to bring their equipment along to meetings, but it must be covered by the members' own insurance. Various interest groups proliferate under the umbrella of the New Mills Club — there is a Sinclair user group, an Acorn user group, a Z-80 group and a Commodore user group.

If members want to exchange equipment, the Club produces a regular newsletter which helps members to keep in touch with Club activities and has a "for sale/wanted" section.

"Everything is buzzing in the Beehive" proclaims a sign on a nearby public house. And just as they do not sting you in the local hostelry, the current membership fee for Kinder Peek Computer Club is only £2 per quarter — £1 for members under 11 years old — and there is no other charge. For further information, contact Martin Flanagan on New Mills 44051. ■

Below: getting the hang of Space Invaders.

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Barrage

BBC Model B (32K): Shoot-'em-up: Program Power. £7.95

★

Barrage is a very misleading title for this game. Each side gets three leisurely shots at the enemy. You must fix the angle and velocity of your shot and then sit back and wait to see if your calculations were accurate. Lack of documentation did not help matters.

Oblivion

BBC Model B (32K): Shoot 'em-up Bug-Byte. £7.50

★★★

Space Invader type game for one or two players. The invaders swerve over the screen as they descend towards you, and chase you up the screen if you try and escape that way. Unfortunately whilst travelling up the screen you cannot shoot and become easy prey to your assailants.

Alien

8 or 16K Vic-20: Adventure: Audiogenic £5.95

★★

You saw the movie, now you can experience for yourself the tension of creeping around a battered spaceship pursued by a nameless horror.

A little more documentation would have made this game more accessible, but if you like copying maps and instructions from the screen, this is the one for you.

A sectional graphic display shows you where you are and another readout lets you know how far away the alien is.

Haunted Hedges

16/48K Spectrum: Eat-'em-up: Micromedia. £6.95

★★

This game is reminiscent of a Pac-Man implementation but with gold coins to collect instead of power pills, and ice-picks instead of boosters. The maze and its inhabitants are viewed from above and at a slight angle. Excellent graphics, a fast game, with ghosts whose intelligence can be varied from zero to super.

SOFTWARE Shortlist

Harrier Attack

- *16-48K Spectrum*
- *£5.50*
- *Durell Software*

★★★

LURCHING AWAY FROM the salt-lashed flight deck and skimming over the whitecaps towards the grim outcrops of an island languishing in the grip of enemy rule, your mission is to bomb the hostile base.

In a game that betrays a little of Defender in its lineage, you have to take off from an aircraft carrier — not always easy in itself — and fly towards the unfriendly coast. The Harrier must fly reasonably fast or else it runs out of fuel while still over enemy territory. That is, if you get there — first dodge the sea-to-air missile launched from the lurking enemy patrol boat. There is ample opportunity here for rolling up your score prior to engaging enemy fighters; apart from destroying the missile it is a cinch to rocket the boat three times and fly straight through the wreckage.

If you fly high enough to avoid the ship, you will attract the attentions of the fighter defence who shoot air-to-air missiles at you. You will also be under constant attack from land-based anti-aircraft fire. At the easiest skill level it is possible to fly through most of the flak but at higher levels the chances of having to walk home greatly increase.

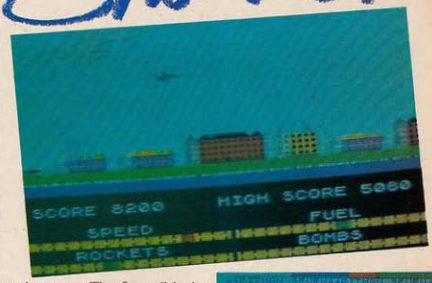
Mid-air explosions as a result of destroying airborne hostiles are also dangerous to you, so the game is a non-stop commitment to weaving, looping and bunting past the various bits of flak and shrapnel that make war such a tiresome business. The game has five skill levels and requires you to deal with seven different controls — but you can get by in combat with four controls. Pressing the space-button means it's a case of goodbye — a little man on a parachute floats free while your machine hits the ground as fast as sound. The graphics are simple but well-implemented and this game proved popular with many people while under test. I counted them all out and I counted them all back.

Sea Lord

- *32K BBC Micro*
- *£7.50*
- *Bug-Byte*

★★

THE UN CONFERENCE on the Law of the Sea may not be getting much support from the U.S.A. but this is nothing compared to the problems posed by the power-crazed Sea Lord. The anti-terranean despot reckons that you have violated his sea-space and dispatches a fleet of scout ships

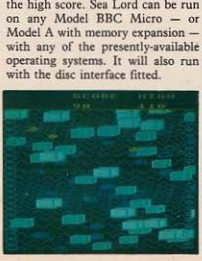


to destroy you. They float guilelessly down the azure depths, weaving effortlessly around the strange white rectangular rock-crystals which hang in suspension in this eerie region of the ocean. Do not be deceived — if they bump into you, it is Davey Jones' locker for you, shipmate.

The real skill in this game comes from developing the co-ordination necessary to get your minisub vectoring in the same direction in which you wish to fire. It is easy enough to pop the rivets on the hapless scouts, but now you have truly incurred the ire of the dotty denizen of the deep. "So you have sunk my scouts?" reads the legend at the top of the screen. "My submarines will finish you off." And if they do not, perhaps the shell-fighters and smart mines will. Four keys are used to control the game: Tab, to rotate the minisub to the left; Q, to rotate the minisub to the right; Copy, to fire the torpedo; and you can also freeze the game with the f0 function key.

Your minisub always moves in the direction it is facing — you start with three lives and a bonus minisub is awarded for every 1500 points score.

Your score is shown on-screen, and the program also keeps track of the high score. Sea Lord can be run on any Model BBC Micro — or Model A with memory expansion — with any of the presently-available operating systems. It will also run with the disc interface fitted.



Pitman Seven

- *48K Spectrum*
- *£5.95*
- *Visions*

★★

VISIONS IS NEW on the software scene and is keen to emphasise that its approach is equally fresh. It is hard to assess whether the best of its first three releases, set in a disaster-stricken goldmine in South Africa, means to assert the new approach by drawing attention to the plight of low-waged blacks, or by departing from the world-wide condemnation of those who profit from their fate.

Your mission is to bring two teams of seven trapped miners from level five of the mine to the surface. The game is basically a Kong format once you get past the spectacular introductory graphic which so unfortunately sets the scene in its controversial location.

Periodically boulders roll down from the surface — you can avoid them by jumping over them or leaping through the trap doors or climbing up ladders to another level.

Another danger is presented by pockets of deadly inert gas. You can avoid these by putting on gas-suits, but this manoeuvre brings up to eight the number of keys you have to be able to use. This certainly is a departure from accepted practice. If you like the idea of this kind of multiplicity of controls, fine, but perhaps the work should be on the part of the programmer rather than the user.

LIST . . LOAD . . RUN . . OR . . DIE . .

VERIFY . . ENTER . . ATTACK . . RESTORE . .

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CYBER RATS*
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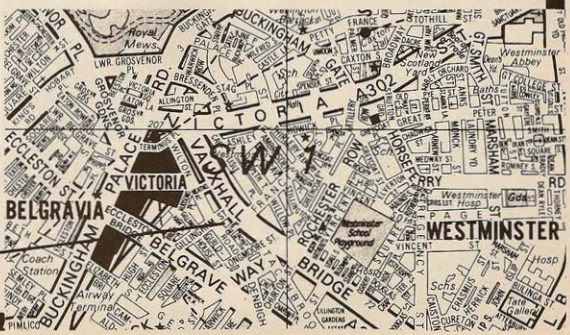

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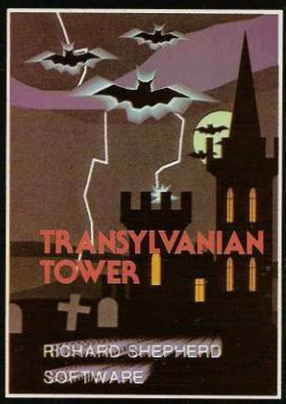

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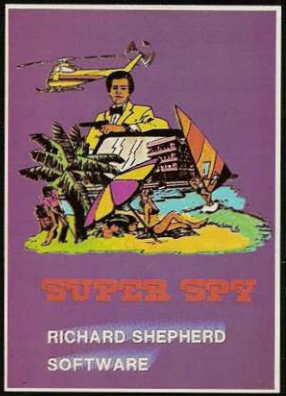

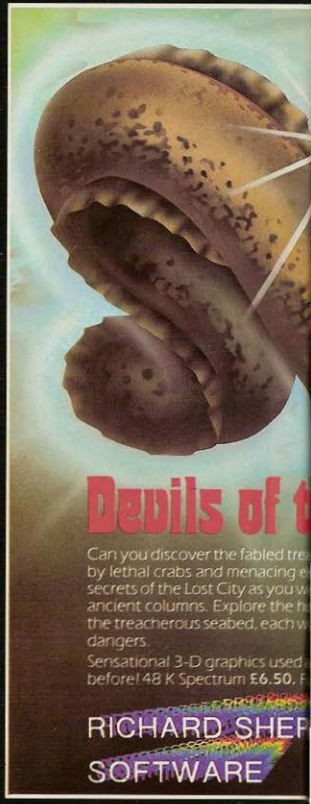

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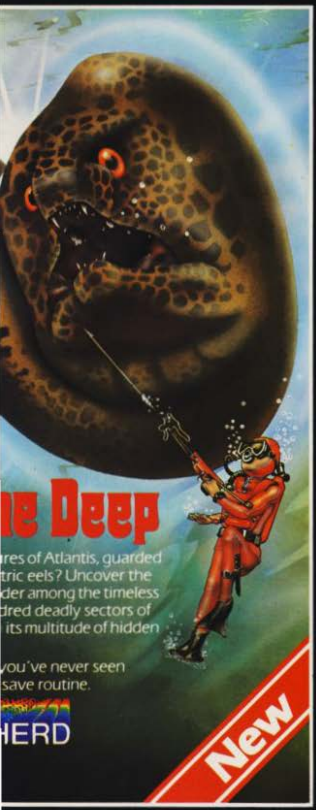

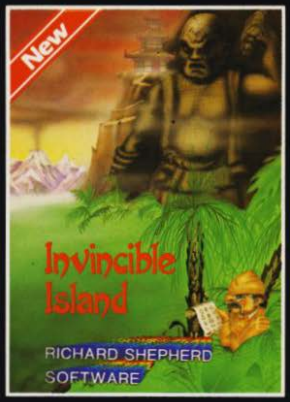

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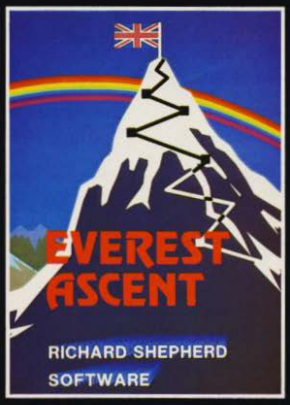

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REVIEW

Simon Beesley looks at the latest machine from the Orient — the Tomy Tutor, to be sold in this country as the Grandstand Tutor.

JAPAN'S LA
CONTEND

JAPAN IS RENOWNED for taking a good idea and producing a superior product from it quickly and at a lower selling price than its competitors. So far the computer field has withstood the threat but with each new Japanese machine that comes onto the British market that threat grows stronger.

The latest machine from Japan to come up for review is the Tomy Tutor. Tomy is one of Japan's leading toy manufacturers. In this country the computer will be sold by Adam Imports as the Grandstand Tutor for around £150 and should be in the shops by October.

Along with the TI 99/4A the Grandstand uses a 16 bit processor, a Texas 99/95 chip running at 3 MHz. It comes with 16K RAM — expandable to 64K — and 32K ROM.

Measuring 36 cm by 24 cm this micro has a more solid appearance and feel to it than most of its sub-£200 rivals. It has 56 raised rubber keys like the Spectrum's but these are firmer and include a spacebar. Above the keyboard there is a cartridge slot and next to it a power-on light. An on/off switch sits at the side of the casing.

Alongside the cassette and joystick sockets at the back there are sockets for monitor and audio output. There is also an I/O port which will take the usual range of peripherals — disc drives, voice synthesiser and expansion units. These are promised to arrive next year.

When you power on you are greeted by a menu with three options — Graphics, Basic or Cartridge. The Tomy's pride is its graphics option. What this offers could be described as a built-in character generator-cum-drawing pad. Effectively it is a computerised paint box.

Once you enter it, in Graphic Composition Mode, you are presented with a 32 by 24 grid. Overlaying the bottom half are 16 colour bars each with the number or letter of its associated key. To the right of this colour menu is what

Tomy calls the palette box.

This acts as an enlargement on the individual cells in the grid. Like a standard character generator it is an eight by eight square in which you can move the cursor to fill in any of its 64 pixels. Each pixel, morever, can be assigned one of the colours from the colour menu, although you are restricted to two colours per line.

While you draw in the palette box one of the cells on the grid is also drawn in. Pressing the space bar toggles the cursor between the grid and the palette. Once in the grid you can move the cursor to fill in further cells and then return to the palette box to redesign a new character.

There is no limit on the number of different characters you can design and if you are painstaking enough you can fill up each of the 768 cells in a different way. When you move the cursor down the colour menu and palette box switch to the top half of the screen leaving you free to fill out the bottom of the grid.

In this way a detailed picture can be built up over the whole grid. Press the Mode key and the Grandstand switches to Graphic Picture Viewing Mode where the colour menu and palette box fall away to reveal your finished work.

There are two additional graphic modes which allow you to design and view up to four sprites on the same grid as your initial picture. Again the palette box is used to define the sprite shape. In the final viewing mode which shows the sprites and cell picture together, the sprites can be moved smoothly around the screen using Grandstand's two joy controllers.

All in all the Grandstand's graphic modes supply a novel and entertaining drawing facility. There are, of course, character generator and drawing programs available for other micros but they are rarely as easy to use or as comprehensive as the Granstand's built-in facility.

In fact, no other home computer under £200 permits you to compose pictures in such sharp detail. The machine's pixel resolution — 256 by 192 — is not much higher than the Spectrum's but its colour resolution is considerably superior. Whereas the pixels within a character space can only be assigned one colour on the Spectrum, each character on the Grandstand can contain 16 different colours. Only the BBC Micro offers the same scope for creating multi-coloured characters.

If you feel your picture should be preserved you can Save it on tape. The loading and saving rate is 600 baud.

To handle the pictures created in the graphics modes there is a graphics Basic distinct from the enhanced Basic option offered in the initial menu. This is a highly stripped down version of the language designed solely to manipulate the cells and sprites on the grid.

It is integer only and lacks arrays and string variables. Its central command is

```
CELL (A) = CELL (B)
```

which copies the cell at position B to position A.

Beyond elementary Basic statements such as Goto, Gosub, For-Next and If-Then the set of available commands is small. There is a simple print statement which prints a string or a number at a given cell position; a key statement which reads the keyboard or joystick; a Time variable; Tone which issues a small range of notes; and commands to move the sprites.

To use GBasic you must first enter the Grandstand's monitor and type in GBasic. The monitor then prints the program on the bottom two lines of the graphics screen. To exit from GBasic is equally awkward and can only be done by typing in End as a program line.

You cannot list or edit a program line although the Step command prints and executes the program a line at a time. Another limitation is that the error message simply informs you that an error has occurred without saying why or where.

As a programming tool GBasic is limited in the extreme. It would be sufficient, however, to create animated graphics or write simple games involving the pictures and sprites previously defined.

In its initial version the Grandstand computer contained only GBasic. When Adam Imports representatives first saw the computer early this year at the Earl's Court Toy Fair they felt that the machine would need a far more substantial version of the language if it were to compete in the home market. Tomy duly obliged by adding on another Basic.

The second enhanced Basic is indeed a more satisfactory version but it suffers from the fact that it exists as a separate option and has no link with the machine's graphic facilities. It is almost as if two computers were housed in the one casing.

It is not possible to access high resolution graphics from within the enhanced Basic, either to plot a point or to design and move sprites. Instead this option confines the user to a text only screen with 24 rows of 32 characters in upper and lower case.

Sixteen colours are still available but only to set the foreground and background colours for the whole screen with the exception of defined characters. Up to 32 of these can be defined by the MCell command and can then be assigned different colours from the rest of the screen characters.

There is no Print Tab command but instead SCell will place one or more of the same character at a given position. GCell returns the code of a character at specified screen co-ordinates.

Auto, Trace and Renumber are usefully included and there is also a Sound command with parameters to set volume, time and pitch.

Although this Basic is an improvement on GBasic it is not an especially extensive version of the language. It does not accept multiple statement lines and — a strange omission this — lacks any string handling commands such as MID$. Compare Tomy's Basic with Sinclair or even Commodore Basic and it begins to look a little threadbare.

Two other commands which are notably absent are Peek and Poke or their equivalents. Both would have been particularly handy for this review since there is no information on the machine's memory organisation. Just how the graphics display is stored and how much RAM it takes up remains a mystery.

Adam Imports is as much in the dark on this as your reviewer — a stream of telexes to Japan requesting more gen on the machine has so far brought no illumination. 32K ROM is twice the normal quota for a machine of this size and one wonders what it is all used for. It may well be possible to bridge the gap between Basic and the graphics modes — for example, to harness the sprite generator.

Certainly the cartridge games I looked at suggest that the Grandstand has considerable unexploited potential. The graphics on these games are probably superior to those on other

(continued on next page)

(continued from previous page)

machines in this price range and the action is fast. 30 cartridges have been produced so far in Japan and most of these will be available over here for around £13.

If enough software is forthcoming the Grandstand could well find a place as a games machine. But whether many people will be prepared to write programs for a relatively uncommon 16 bit processor is another matter.

The machine's other possible role is indicated by its full name, the Tomy Tutor — in the UK, the Grandstand Tutor. This would be a highly suitable micro to introduce children to computing. The graphics option alone is interesting. You can plunge straight into drawing on the graphics grid without any knowledge of programming. And if this stimulates the desire to learn programming there is at least a limited facility for doing so.

However, in the under £200 market it is difficult to compete with a £130 48K computer like the Spectrum. Success breeds success and particularly in the home computer world. Once a micro starts to sell well more people are encourage to write software for it and the more available software the more attractive the micro.

CONCLUSIONS

- There is already an enormous amount of quality software for established micros like the Spectrum and there is very little software support for newcomers.
- The Tomy Granstand may not be able to compete with the Spectrum on its own ground but it could find a niche in a more specialised area — as an educational device which doubles as a games machine.

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Just as Henry is getting in to his evening at the tables his wife — Mad Martha — has noticed his absence. Realising Henry has absconded with the housekeeping she sets out after him with an axe.
Guess what part you play in this happy tale? That's right, you're Henry. Watch out for that axe!

Mad Martha ... a marvellous adventure, the whole program is really dotty and a refreshing change from some of the doomladen programs encountered nowadays ... in this game you will not get to the next stage without solving the present conundrum. ***Popular Computing Weekly***

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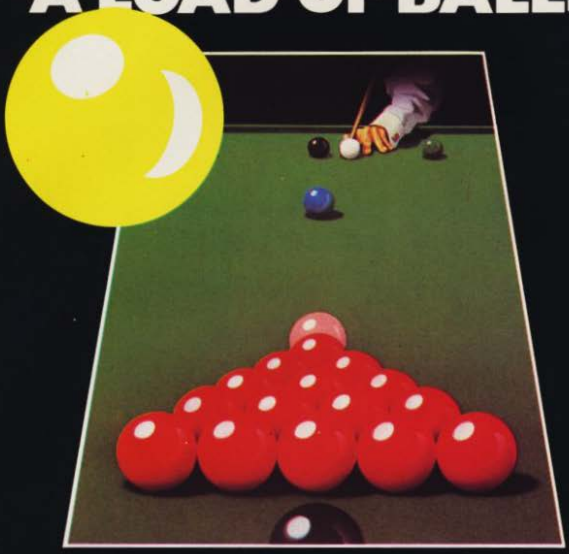
MAD MARTHA II
(Henry sails the Spanish Main)

Time for the annual holiday and Martha decides to visit her half-cousin Manuel, who is a waiter in a plush hotel in Barcelona.
One afternoon, Martha sets out on a bus tour with her son, young Arbuthnot, leaving orders for Manuel to keep an eye on Henry. Unbeknown to Martha, crafty Henry has a Spanish pen-pal, and has planned a secret rendezvous. Henry leaves the hotel, brimming with enthusiasm and Manuel (who is totally wacky!) is hot on his trail. The adventure takes us through the thrills and spills of a madcap chase, taking in amongst other delights, a bull fight in which poor Henry is forced to play the leading role. Guaranteed laughs and fun for all the family!

This is a game to invest in ... it's funny, it's genuinely original and the graphics are great ... Hit the key to begin, the Spectrum plays a real Holywood-style movie theme tune, and the hunt is on! ***Personal Computer News***

MORE THAN A LOAD OF BALLS



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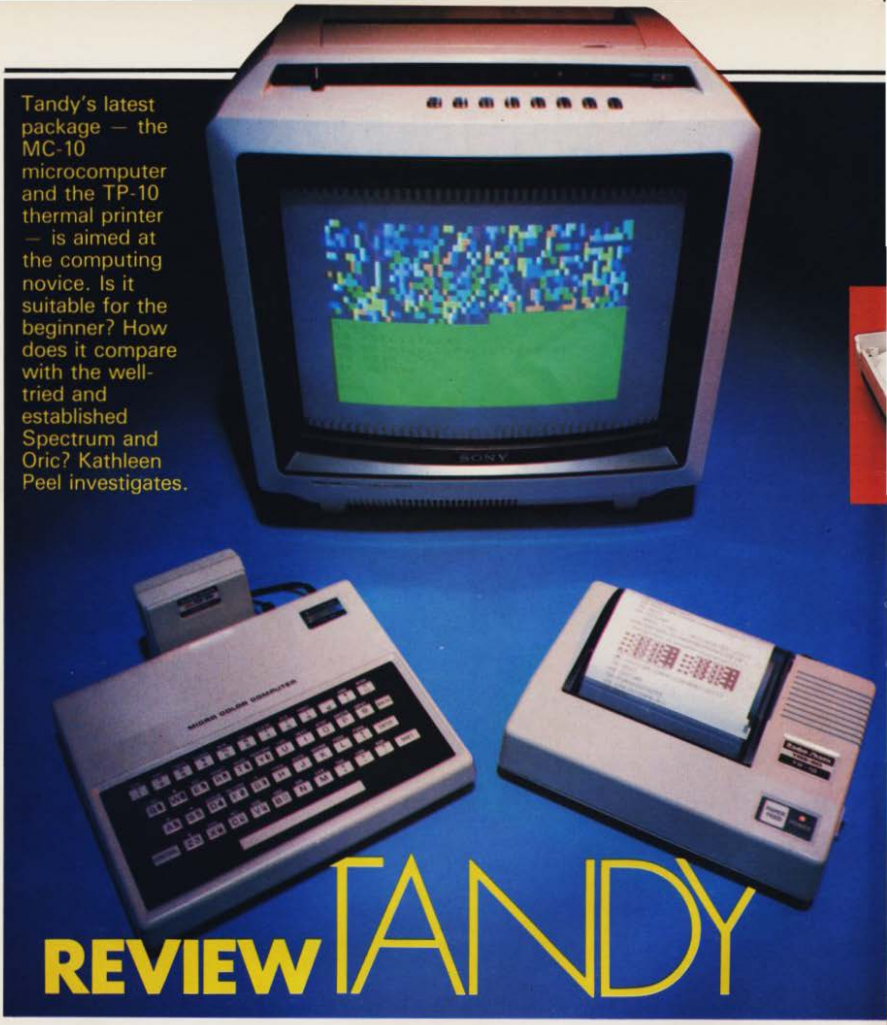
Tandy's latest package — the MC-10 microcomputer and the TP-10 thermal printer — is aimed at the computing novice. Is it suitable for the beginner? How does it compare with the well-tried and established Spectrum and Oric? Kathleen Peel investigates.



REVIEW TANDY

TANDY HAS RECENTLY brought out a number of new machines aimed at increasing sales and revitalising the product range. The Model 100 will do just that in the portable market, but whether the MC-10 will have the same success remains to be seen.

The MC-10 is aimed at the computing novice who wishes to learn about computing on a simple no-frills Basic machine. It will be launched with a compatible new thermal printer, the TP-10, priced mid-way between the low cost/low quality ZX printer and the highly successful badge-engineered Sharp four-colour printer/plotter.

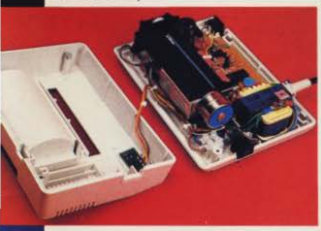
The computer is based on the 6803 processor — a 6801 without the on-chip 2K ROM — and the MC6847 video display generator. 4K of user RAM is provided which may be extended to 20K by using a RAMpack. The computer is capable of displaying nine colours and of producing sound through the television speaker.

As with all Tandy products, there is little one can criticise in the quality of the construction. The robust case — the unit weighs nearly 2lbs — contains a printed circuit-board which is well laid out without any changes or modifications.

The keyboard is ¾ full size and looks small; hard plastic keys provide a feel as good as any other keyboard of this type and at least there is a spacebar. There is, however, no audio feedback or auto-repeat on the keys.

Words may be typed in full or control-keyed in if it is a keyword and if it is above one of the keys. It is good that both are available but as not all the common keywords are represented you do tend to spend rather a long time looking for those not there. I wonder who decided to put the Break Key just above Enter — I thought this type of mistake had been eliminated, but it is tending to creep back

Above and below: Open and shut case — the TP-10 thermal printer.



with, perhaps, a new generation of designers not having learnt from their predecessors' mistakes.

At the rear of the computer there are connectors for the AC adapter, the TV connecting cable, a 5-pin DIN socket for the RS232 interface, an edge connector for the memory expansion protected by a cover plate and also a Reset button, used to provide a warm start.

The first problem with the operating system is the editor — there isn't one! You cannot edit an existing line, all that is available is a simple backspace delete to correct a line as it is entered and a line delete to remove it altogether when you have lost patience. Error messages are given by two letter abbreviations; far better than error numbers but still not as good as the full error message.

For a machine aimed at the novice, the meanings given for the error messages might just as well be in Latin for all the good they are to the beginner; for instance out of string space or file mode error. They need to be explained with many examples to be of serious use. Switching on will produce the message:

MICROCOLOR BASIC 1.0
COPYRIGHT 1982 MICROSOFT
OK

written in black letters on a green background with a black border. Print Mem obtains the amount of free space left for your programs, 3142 bytes initially.

The cassette interface operates at 1500 Baud and appears reliable. Speed variations of −12 percent to +20 percent were tolerated and the three modes of cassette Saving were all satisfactory, manual, manual with peak clipping and automatic, all with considerable tolerance on the level of playback.

On Loading a tape, the computer clears the screen and places an S — searching — in the top left hander corner, an F — file name — shows the file has been found, followed by OK on completion of loading.

Program I can be used to list all the ROM keywords, and note that they are not all listed in the manual. The Basic is Microsoft Basic, all the keywords have their standard meanings and there are even simple structures On . . . Gosub and On . . . Goto. Table 1 gives speed comparisons with the Spectrum and Oric.

Displays may be created using the quartered graphic block characters which can be any two of the available nine colour in each — 32 by 16 — character position. This produces an effective pixel resolution of 64 by 32 and a colour resolution of 32 by 32. Alternatively the pixels may be set — switched on — and reset — switched off.

There are no draw or circle commands. Whether this level of resolution is adequate in today's market is debatable.

The sound is produced through the television's loudspeaker and so may be as quiet or loud as is required. It is only a single channel but, with the added external volume control, is a considerable improvement over the Spectrum beep. The sound may be varied in frequency and duration.

With the MC-10 comes the Operation and Language Reference Manual and a notice for non-American users. Accepting that the MC-10 is for the novice, it is difficult to know what to say. The beginning of the manual is so obviously intended for the American user, it is going to confuse the beginner before he has even got the computer wired up.

The correction notice does not cover all the necessary references to the American system. The one saving grace is that this machine will only be supplied through Tandy stores and from them you will at least get expert advice on how to set the computer up.

The remainder of the manual on learning and using Microcolour Basic is quite good. There is even a summary sheet which contains all the Basic statements with syntax, error messages, functions, etc. a nice idea.

I would advise early purchasers to obtain Tandy's *Getting Started with Colour Basic.* Many of the Basic programs will work on the MC-10 as they stand and even though a

(continued on page 71)

Program 1.

```
5 LPRINT
10 FORA=49221TO49479
20 IFPEEK(A)>128THEN60
30 LPRINTCHR$(PEEK(A));
40 NEXTA
50 STOP
60 LPRINTCHR$(PEEK(A)-128);
70 GOTO40
```

ROM keyword dump.

FOR	GOTO
GOSUB	REM
IF	DATA
PRINT	ON
INPUT	END
NEXT	DIM
READ	LET
RUN	RESTORE
RETURN	STOP
POKE	CONT
LIST	CLEAR
NEW	CLOAD
CSAVE	LLIST
LPRINT	SET
RESET	CLS
SOUND	EXEC
SKIPF	TAB(
TO	THEN
NOT	STEP
OFF	+
-	*
/	^
AND	OR
>	=
<	SGN
INT	ABS
USR	RND
SQR	LOG
EXP	SIN
COS	TAN
PEEK	LEN
STR$	VAL
ASC	CHR$
LEFT$	RIGHT$
MID$	POINT
VARPTR	INKEY$
MEM	

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Spectrum software

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Typical printer output.

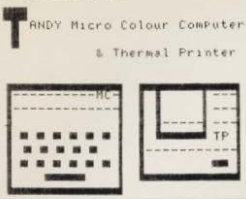
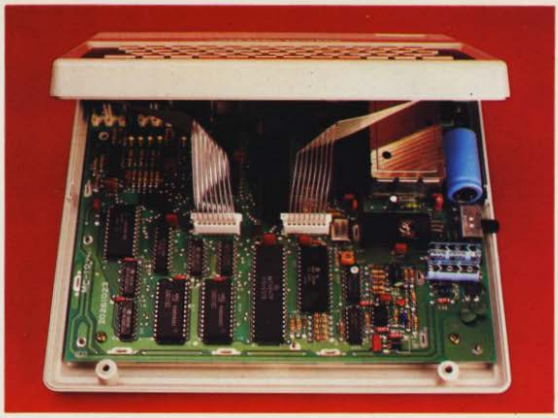


Figure 1: Printer dump of characters.

```
1 FORA=32TO255
2 LPRINTCHR$(A).
3 NEXT
```

(continued from page 69)

number of the chapters are specifically for the Colour Computer, it is perhaps a good starting book.

To enable machine-code programs to Run CloadM, Exec and USR are implemented in the Basic. The machine also seems to understand the joystick commands, but quite where they will be fitted I am not sure.

There are obvious differences between the MC-10 and the Colour Computer besides price; the display file has been moved and generally the memory map has been changed.

It remains to be seen whether the user can assess the page select register, video display generator and display control register to obtain the high-resolution of the Colour Computer.

Compatible with the MC-10 and the Colour Computer, the TP-10 RS232 thermal printer manufactured by Canon for Tandy is destined to become very popular.

The printer is 8 by 6 by 3 and weighs 3½lbs. It prints 30 characters per second, 32 characters per line on 3¼inch wide thermal paper with a line separation of 0.167 inch. The grey case matches that of the MC-10 and the TP-10 is also very well made. The print head is tracked across the paper by a stepper motor which operates extremely quietly, the only noise is on the line feed mechanism. The printed-circuit board is well laid out with the sensitive circuits well screened.

There are two operational switches, a rocker on/off at the side and a membrane type touch switch for the paper feed. An led indicates power on/off and will flash if the print head jams.

The printer operates at 600 Baud with one start bit, eight data bits and two stop bits — no parity.

Files may be LList to the printer and you can also LPrint a line, but their is no copy facility on the MC-10 to produce a screen dump which is a pity. Having created a masterpiece on the screen, to make a hard copy requires every line with a print statement to be retyped in full — there is no editor.

Do not try to Reset or to Save the cassette with the TP-10 connected to your computer as the printer starts to produce garbage if you do. I also found occasionally that the print buffer was not cleared from previous calls. As this machine is alleged to be compatible with the MC-10, this particular problem is hard to understand, a bit disturbing but no real problem.

Paper loading was simple and straightforward, cut a reasonable edge, feed into slot and press the paper advance button — very good.

The instruction set is given in Table 2. There is provision for double width printing, underscoring, overwriting and repeating characters. The alphanumeric characters are made up of a 5 by 7 dot matrix, the graphics characters are produced in a 7 by 12 dot matrix which interestingly means that the graphic quarter blocks are unequal in size, the left hand quarter blocks are 3 by 6 and the right hand blocks 4 by 6. Figure 1 gives the printer dump of the character set.

The print quality is very good. Figure 1 which shows the full character set also demonstrates the only minor faults of the printer — no pound sign and no lower case descenders for g, p and q. The print is exceptionally clear, one can even pick out the individual dots in the graphics characters. An excellent well laid out manual should get anybody started.

Prices: The MC-10 is £99.95; TP-10 is £79.95; RAMpack is £39.95, and paper rolls are £2.79 pack of two.

Table 1. Speed comparison

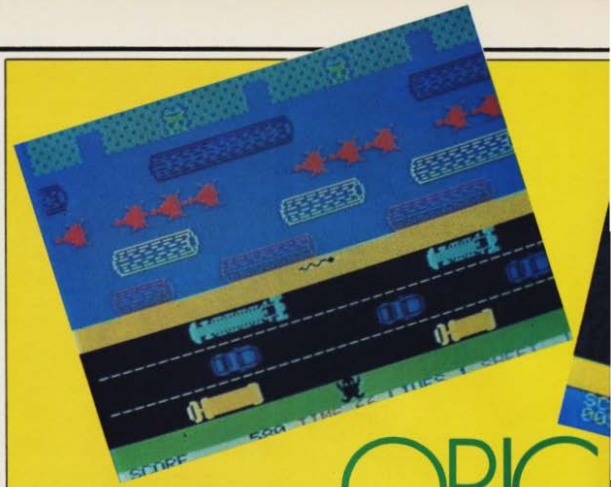
	MC-10	SPECTRUM	ORIC
TIME TO LOAD ARRAY (Secs)	8	13	15
TIME TO SORT ARRAY (Secs)	164	286	300
SPACE OCCUPIED BY PROGRAM	227	339	225
SPACE OCCUPIED BY VARIABLES	5033	5037	5036

Table 2.

CODE	FUNCTION
CHR $ (10)	linefeed
CHR $ (13)	Return with linefeed
CHR $ (26)	Return without linefeed
CHR $ (27)	CHR $ (14) Elongated mode on
CHR $ (27)	CHR $ (15) Elongated mode off
CHR $ (28)	CHR's (n) CHR $ (m) repeat n times (0-255) ASCII code m
or CHR $ (28)	CHR $ (5) "T" prints five T's

CONCLUSIONS

- Without high-resolution graphics, I think the MC-10 is over-priced. It is effectively a ZX-81 with colour, sound and a better keyboard which, compared to the 16K Spectrum with its established software base, makes the MC-10 a non-runner. A year ago when there was significantly less choice it might have developed a following, but now there are too many better machines available.
- The TP-10 is a different story. Tandy seems to have the ability to pick quality accessories to go with its products and this is no exception. The print quality is good and for £80 represents extremely good value for an RS232 printer.
- The running costs will probably be lower than the ZX printer so I think there will be a very large number of Spectrum owners who, when they acquire their Microdrive interface, will find this an extremely acceptable printer. The graphics characters are not the same for the two machines so the Spectrum will require a translator. I can see no reason why the Spectrum copy facility should not work. ■



Above: Hopper from PSS Software.

ORIC SOFTWARE

Pete Connor gets that feeling of deja vu as he tackles the aards and paratrons, repels the invaders, flies a Harrier mission, tries to take over the Ewing oil empire and boldly goes where no man has gone before. And you thought that software reviewers had it easy.

ORIC IS ONLY A stripling compared to its older brothers Vic, Spectrum and BBC, yet already the software is beginning to accumulate. Sadly, few software houses have thought to produce anything very original, preferring instead to rely on the tried and tested, and just a trifle boring, arcade standards. Far too many producers seem to think that familiarity breeds content; perhaps the consumers will soon teach them what the proverb really is.

The creditable attempt at something almost original is Xenon from IJK Software. Almost, because the old hands among you will discern traces of Galaxians in this game, albeit weirdly mutated. As a fleet commander in the Xenon Space Academy you have to journey to the planet Radon and protect it from the Zorgon Battle star.

On the way you take on a variety of foes, beginning with the war-like aards. These are whirling, unpredictable creatures which close on destruction, thus proving rather difficult to avoid. They also bear a strange resemblance to that prickly fruit, the Chinese gooseberry. The next hazard is a shower of fireball meteorites which you can dodge but not destroy. The final obstacles before reaching your destination are the paratrons; rather cute little parachuting soldiers whizzing down the screen.

Uses the Oric's graphics

Despite its slightly derivative nature Xenon is an entertaining game which uses the Oric's graphics with flair and imagination. IJK also produces Candyfloss, a business game for the Juvenile Capitalist. Here you have a stall selling your sticky wares on the Golden Mile at Blackpool.

You are given a limited amount of capital to spend on raw materials and advertising and have to maximise your profits in the face of the variables all entrepreneurs face; the weather roadworks, rogue donkeys etc. The program begins with a jaunty rendition of I do like to be beside the seaside and a colourful graphic display of Blackpool's sands resplendent in the summer sunshine.

You set up your stall, fix your price and hope for the best. Thunderstorms mean bad business; sunshine means juicy profits. The game introduces younger players to the rudiments of business and will also help improve their maths. Older players, though, may not find it holds their interest for too long. Also on the tape is Hangman; unfortunately there were no loading instructions, so I cannot pass judgment.

Arcadia has a version of Invaders on the market; no marks for originality there. The blurb claims that this is "an arcade performance, shoot 'em-up, action packed, video game . . . indistinguishable from the original arcade blockbuster".

Well, just hang on a minute there boys. Arcadia's Invaders is a pretty good version, with vivid colours and nice sound-effects, but if anyone cannot tell the difference between it and the original arcade blockbuster they need their CPU looking at. Invaders is neither better nor worse than standard issue.

Perceptive readers will realise that the name Mushroom Mania conceals a well-known arcade personality with many legs. This Arcadia game is a good version of an arcade standard. All the usual features are there; bugblaster, spiders and a non-sexist "pacperson" which gobbles everything in its path.

Again, too, Arcadia makes absurdly inflated claims for the game; "The higher your score rises, the faster the action becomes, until it is only a screaming blur of colour and sound". Perhaps this is why the Oric has a reset button.

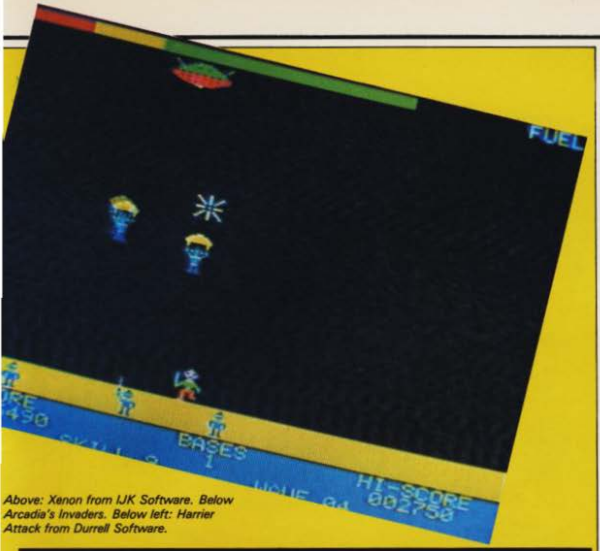
No jiggery-pokery

P.S.S. Software disclaims any jiggery-pokery with names; for this company a centipede is a centipede. There is not much to choose between this and Arcadia's version, both being fast, furious and difficult to play without a joystick.

Invaders, also from P.S.S. is the usual thing. The colours are good and the sound effects increasingly frantic. Unfortunately, I can find no reason for preferring P.S.S's programs to Arcadia's and vice versa.

P.S.S. also produces Hopper, a game in which you must guide a frog across busy roads and crocodile-infested rivers. Perhaps you are familiar with that kind of thing? I believe there is a game called Frogger which is rather similar. Here the colours are shockingly bright, but there is the slight novelty of having to avoid a deadly tadpole slithering about on the other side of the road. Otherwise . . . standard issue.

On the subject of shoot 'em-up games, there is Harrier Attack, from Durrell Software, to be considered. As a veteran of many a prang on Scramble missions I looked forward to this one, and was even prepared to sit patiently through the 10-minute loading process.



Above: Xenon from IJK Software. Below Arcadia's Invaders. Below left: Harrier Attack from Durrell Software.

During this wait it is possible to study and admire the cover illustration, which shows two Harriers banking high above somewhere like Goose Green.

Scramble at sea

When the game eventualy starts, it is evident that it is really Scramble at sea; you take off from an aircraft carrier, fly your mission and try to conserve enough fuel to land again afterwards. The sea is a tempting blue and the graphics are not at all bad. The game is quite fast, even at the lower levels, and not easy to master.

My most humiliating death came when I crashed into the control tower on take-off. However, there is a lack of variety in the obstacles; these seem to consist entirely of planes and anti-aircraft guns.

Although I found the game enjoyable, almost gripping, for a while I suspect that repeated missions would soon become rather boring.

Dallas and Airline are two strategy games from Case Computer Simulations. The first, says the blurb is a "board game of exploration and exploitation in Texas". You must accumulate $200 million assets and $80m in cash in order to take over the Ewing Empire. Sounds familiar, but unfortunately there is no J.R. — or Sue Ellen, or Lucy — to add human interest.

You have a rather crude map on which you choose a site to make a seismic survey. If you strike oil you then have to transport a rig, build a pipeline to Dallas and develop more fields. All this, of course, costs money and, if you do not find a gusher pretty soon, you will be begging for loans; get too deeply in debt and you will be ripe for takeover by those nasty Ewings. But the game never really grips, perhaps because there is not real skill or strategy involved on the players' part.

British Airways takeover

Airline is similar, but a little more interesting. The game is a kind of "Every man his own Freddie Laker". You must increase your £3m to £30m within three years in order to take over British Airways.

You must decide how many planes to charter, how many cabin and ground crew to employ and how much insurance to buy. Make the wrong decision and your planes could be banjaxed by a hijack or grounded under safety regulations. After each year's trading you are shown a balance sheet which gives you your profit, or loss, figures. If you lose too much you will emulate Freddie Laker, as I did, in being liquidated.

As with Dallas the problem in this game is that there is no real challenge for the player; too much depends on chance and not enough on any skill or expertise. Still, those with a desire to be a living room magnate will find it worth investigating.

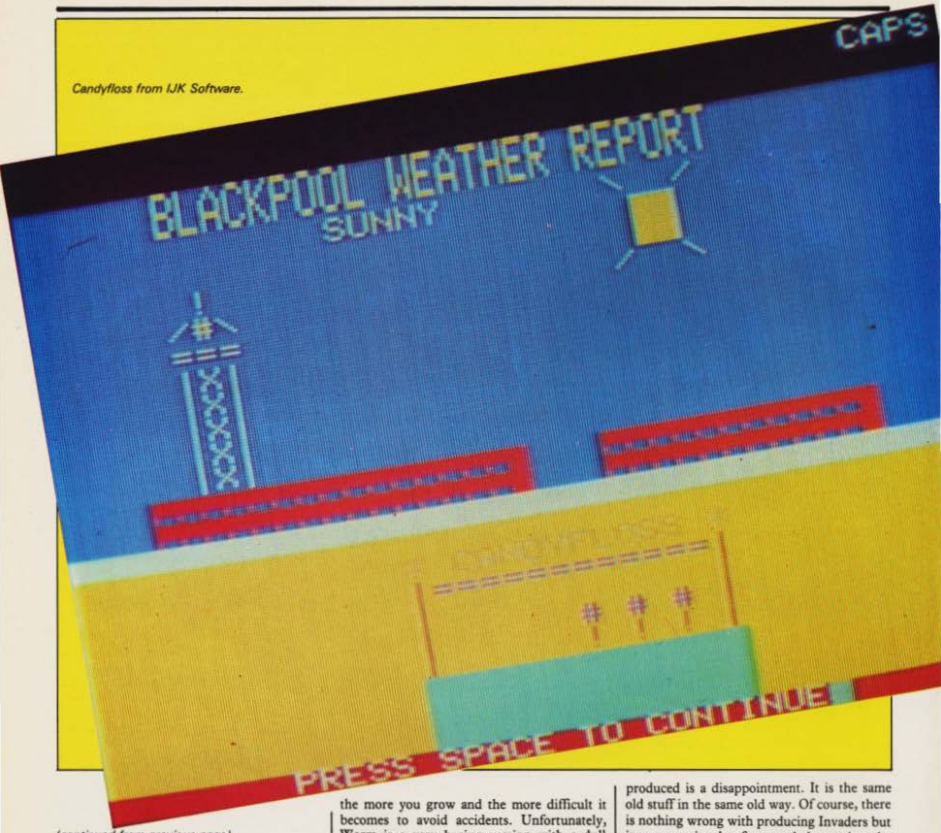
A&F Software has produced a version of Painter for the Oric. This familiar game, in which you have to draw round a number of boxes while pursued by a whirling thing, is more or less the same as versions I have seen for other machines. The colours are quite pleasing and there are different configurations of boxes as you progress through the pages. Those who like a nice game of Painter now and then will not be disappointed.

Star Trek-based game

Oric Trek, from Salamander Software, is one of those games based on Star Trek where you must seek out and destroy hostile life forms wherever they are found. To find them you have a long range scanner on which appear blinking and to me, incomprehensible dots. Then you destroy them using phaser or phantom bombs. Alternatively you can use your shields or just run away. I do not really understand the appeal of such games but Salamander's version for the Oric seems to be up to scratch.

We beam down to Sector 7 software for the next program. This is a games pack, featuring seven different games. The first, Laser Station, features a green flying saucer raining down bolts on your laser bases. Your laser automatically scans the sky and you have to try to destroy the bolts until the saucer descends to firing range. Each time you fire your energy is depleted until, if you are not careful, the saucer has descended and you have run out of ammunition.

(continued on next page)



Candyfloss from IJK Software.

(continued from previous page)

Demolition, another game in the pack, is a simple version of Scramble, though not without charm. Here you find yourself on an old abandoned planet with only three ships. In order to land you must first destroy the ruined cities. These consist of blocks of skyscrapers. Your ship repeatedly flies over them while you drop bombs in an attempt to flatten them into Heathrow. The game is quite enjoyable but so simple that its impossible to imagine it retaining any interest for long.

Other games on the tape are Noughts and Crosses, Obstruction, a maths game and a maze game. While such packages seem initially tempting, they may well be a false economy; with seven games on one tape, how can any of them have any real complexity or lasting appeal?

Last, and by all means least, is Worm from P.A.S.E. This is a Snake-style game where you have to manoeuvre your creature around the screen and gobble numbers. The more you eat the more you grow and the more difficult it becomes to avoid accidents. Unfortunately, Worm is a very boring version with a dull screen display.

On the whole the Oric software so far produced is a disappointment. It is the same old stuff in the same old way. Of course, there is nothing wrong with producing Invaders but it seems a pity that few people have taken the opportunity provided by a new machine to do something different.

Company	Program	Price
P.S.S. Software, 452 Stoney Stanton Road, Coventry, CV6 5DG.	Centipede	£6.95
	Invaders	£6.95
	Hopper	£6.95
P.A.S.E., 213/215 Market Street, Hyde, Cheshire.	Worm	£4.99
I.J.K. Software 9 King Street, Blackpool, Lancashire.	Candyfloss & Hangman	£7.50
	Xenon	£8.50
Salamander Software, 27 Ditchling Rise, Brighton, East Sussex.	Oric Trek	£9.95
Arcadia Software, Freepost, Swansea.	Invaders	£5.50
	Mushroom Mania	£5.50
Durrell Software, Castle Lodge, Castle Green, Taunton, Somerset.	Harrier Attack	£6.95
Case Computer Simulations, 14 Langton Way, London, SE3 7TL.	Dallas	£7.95
	Airline	£7.95
Sector 7 Software, PO Box 8, Newton Abbot, Devon.	Gamespack	£7.00
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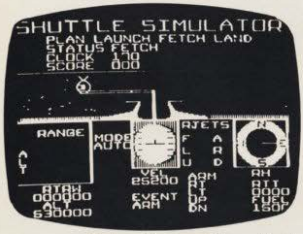

ARM STAGE

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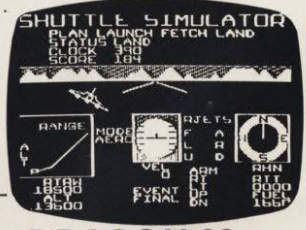

FINAL STAGE

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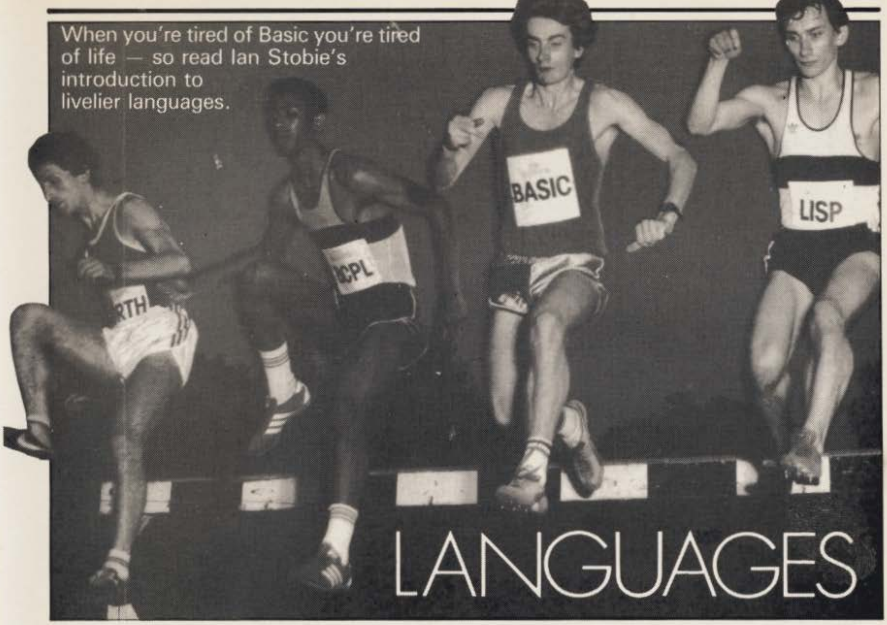

LANGUAGES

PROFESSORS KEMENY AND Kurtz could not have guessed back in 1963 how successful their new language, Basic, was going to be. Their immediate problem was how to broaden the use of the computer at Dartmouth College in the U.S.A., where they taught, beyond the scientists and engineers who were monopolising the system. So they developed an easy language suitable for anyone to use — their Beginner's All-purpose Symbolic Instruction Code.

Basic does its job really well, but what happens when you stop being a beginner? Are other languages more advanced, or more powerful, or more fun than Basic? In this survey we look at some of the other languages used on microcomputers, giving special attention to Forth, Pascal, BCPL and Lisp.

First let us get straight what a programming language is. Back in the 1940s, the very first computers were programmed physically. To get a machine to do a different set of calculations would involve a skilled engineer physically reconnecting it on a great plugboard resembling an old fashioned telephone exchange.

Machine language was the first big breakthrough. The key idea was to store all these reconnection details in memory, as a sequence of program steps. Memory was already being used to hold the intermediate results of calculations, so the memory technology existed.

With this new stored program computer you would load a program into memory, and the computer would then fetch the stored instructions in sequence and automatically rearrange its own electronic pathways to carry out the operations specified. To people at the time this must have seemed amazing — almost like the machine controlling itself. But it was only the beginning of programming as we know it.

What was needed was a higher level language to program in, a language which would allow you to write your instructions in a way convenient to you. An automatic translation process would then generate the necessary machine language steps to carry out your high level language instructions.

In this way the computer would still operate according to low level machine lanaguage instructions stored in memory, but the human programmer would not have to program them directly. All modern high level languages, such as the ones covered in this survey, are still based on this principle of translation to machine language.

Fortran was the first such high level language. The name stands for FORmula TRANslation, which indicates that engineers and scientists were still the main users of computers when it emerged in 1954.

Once you can program in a language which is close to the way human beings think about

(continued on page 79)

DRAGON FORTH

Dragon Fig-Forth from M and J Software offers standard Fig-Forth, includes the full editor vocabulary as part of the core and also includes an assembler as an add-on program. There are no Dragon graphics control words and primitive sound commands. However this is balanced by very good documentation including the complete Fig-Forth installation manual.

The M and J manual that comes with it is full of Forth program examples and one or two words are very useful. Perm makes any added definition permanent by moving the fince to the latest defined word, thus inhibiting the Forget instruction. At the same time there is no Forth-Save, so, in order to Save an up-dated version of Forth, it is necessary to quit Forth, use Dragon Basic Peeks to find out where the program is, note the start address, number of bytes and end address and then CSaveM.

Missing instructions can easily be added. The computer already has built into its Basic many commands and operations, such as floating point arithmetic, which are not available to the Forth user.

To get around this, another version for the Dragon 32 by Oasis Software allows the user to hop between Forth and Basic using the best features of both systems.

David Scobie

BBC

BCPL

BCPL was developed in 1967 by Martin Richards as a follow on from the Combined Programming Language project at Cambridge and London Universities. It is the first ROM based language, other than Basic, to be released for the BBC micro by Acornsoft.

Upon parting with your £99.95 for the BCPL pack you receive a 16K ROM which plugs into one of the spare Page ROM sockets of the BBC, a 40/80 track disc containing utility and example programs, and a very comprehensive, 450 page, user guide in paperback book form. There is also a very necessary function key strip so that the program editor utility can be easily used.

I found the system easy to get up and running and there is a section of the user guide devoted to getting started. In this chapter there are examples of installing the ROM, starting the language, and using some of the utilities in conjunction with some example programs on the BCPL disc.

Newcomers to BCPL will find a resemblance between the familiar BBC Basic and BCPL. It would appear that the authors of this modern version of Basic were well versed in the use of structured languages such as BCPL. On the surface this would appear to make it easy to switch from Basic to BCPL, and in fact some of the familiar Basic commands such as Adval, Envelope, Mode, Sound, VDU have been supplied as equivalent standard procedures in the BCPL ROM to aid you in this conversion.

BCPL has a much more formal appearance than Basic with requirements such as needing all variables to be declared using a LET statement before use. For example:

```
LET highest = 100
```

would tell the compiler that the variable highest has an initial value of 10. Several variables can be declared at once. For example:

```
LET x, y, z = 0, 1, 2
```

There are all the usual control structures such as If . . . Then, For . . . Do, Repeatwhile, etc. There is no excuse for not writing a perfectly structured program. Similarly procedures are used to make the program as well structured as possible.

BCPL operates only on 16-bit words which can be used to store integers, ASCII characters, addresses, in fact it is up to you to decide if the program is doing something stupid like multiplying ASCII characters. This single data type means that functions such as floating point arithmetic are not available and you are limited to +,-,/,*,Not,And,Or etc. Similarly only single dimension arrays or vectors are available.

In this version of BCPL the compiler does not produce true machine code for the BBC micro's 6502 processor chip. Instead an intermediate code is produced. This Cintcode is then interpreted by the BCPL ROM when the program is run. In this way the compiler can be kept small enough to fit onto the 6502 and run at reasonable speed. The Cintcode is a very compact way of storing the program and has the advantage of being fully relocatable. In this way sections of the program can be loaded into memory only when needed.

This scheme positively encourages the use of modular programming, allowing coding and testing of each piece of program in isolation where things are well understood and problems are easy to deal with. An added bonus is that modules can be collected into libraries and reused in other programs.

Of course, nothing comes for free and the price payed for using Cintcode is the speed loss due to having the interpretation of Cintcode into 6502 machine code as the program is running. This means that a typical BCPL program will only run about three times faster than an equivalent BBC Basic program instead of the expected 10 to 100 times if a "real" compiler was used.

In conclusion I found the package interesting but I feel that there is not much advantage to the home user in writing in BCPL rather than the excellent BBC Basic. If a real compiled version of BCPL was available, with the inevitable speed increase, I might be forced to change my mind.

David Simpson

LISP

Lisp is one of the most extensive and powerful languages of all, yet oddly enough it is not very well known. Until comparatively recently, it has only been available on mainframes and minis but now Acornsoft's release of Lisp emphasises the growing diversification from Basic on microcomputers to more specific languages for specific purposes.

Lisp or LISt Processing language was first used in the very practical field of database manipulation, particularly in medical and educational areas, where it is still used to control the accessing of data from non-specific pieces of information or keys, to do more complicated searches on data than the predictable "Field Address Smith. J." .

It was this unique property of the language that showed it to be useful as a tool for researching into artificial intelligence and it is the use of Lisp that has afforded the language most of its publicity – artificial intelligence makes good copy. In fact some of the best reported programs of all have been written in Lisp; programs to write programs, design integrated circuits, make conversation, control robots or write poetry have all been well-publicised.

Oddly enough, there is no definitive version of Lisp – unlike Dartmouth Basic, or Jensen and Wirth's Pascal – so many dialects have arisen from the original ideas. Fortunately, most of these are not too disparate and the adaptations needed to enable you to take Lisp from one machine to another, are generally few. For this reason, Lisp is considered to be a fairly portable language – unlike Pascal for example, which is different enough, in the half dozen versions I have used, to make portability tricky.

Acornsoft's implementation arrives in three possible formats: disc, cassette or ROM – all of which are simple enough to use, though cassette is obviously more laborious. The remaining part of the package is the book which at £7.50 may yet make pirates think twice – the software is hard to use without the book.

The Lisp itself is easy to use since it is both a complete implementation and features the added benefits of the BBC's VDU and call commands. It also allows the more devious user to use Peek and Poke. Escape and Break have their normal functions, though Old after Break is replaced by Call Page+2, and a random chance of retrieving a corrupted Lisp. *Caveat Emptor!* Another feature I found irritating, rather than actively discouraging, was the heap of little arrows that appear when you have unmatched brackets. Count them to see how many brackets you are missing. I am sure the computer could have been persuaded to do this trivial task for you.

Fortunately, Acornsoft has had more sense when it comes to screen displays. It has left the Ctrl N and Ctrl O functions available, and this is particularly important with Lisp's vast error messages. Until I discovered this, I watched with some concern as pages of errors flashed by on their way to oblivion.

The reason for this quantity of error information is known as the backtrace and is ultimately, what makes Lisp so easy to debug. The backtrace helps pinpoint just where it was you slipped up.

The manual is extremely well written, and also structured well, in that it allows you to play with, and program in, Lisp before you even start to understand it. it also works as an effective teacher – I passed the package on to a non-expert friend who knew Basic and little more. He now knows Basic, Lisp and a little more.

Piers Letcher

PASCAL

Pascal is one of the most sensible and useful programming languages. It is totally structurable, easily readable, and well thought out. All of which you would expect from something designed by Niklaus Wirth. In its full implementation it showcases many of the features that are often desired in more common languages such as Basic.

For example, easy block structuring, the possibility of avoiding the Goto statement, recursion and highly sophisticated parameter handling to and from procedure are all features of Pascal at its best. Its only major disadvantages up to now have been its poor Input/Out and its lack of any special graphics handling facilities.

The former is due entirely to Wirth's desire to keep Pascal portable. To this end no I/O was defined at all, and was left to each machines' implementation to be sorted out. Pascal also has two major advantages over many languages: it is easy to read and to write. The former is due to good Pascal programs being almost entirely self-documenting. Obviously the readability is governed by sensible programming ie., sensible variable and procedure names, and a practical top down or bottom up structure.

In both cases the instructions for how to get your Pascal into your machine are excellent, though Hisoft's provision of an extra, loose sheet of A4 for this is perhaps dangerous. Loose sheets of A4 can get lost.

Hisoft is quite clear that its manual is not intended to teach you Pascal, but is intended to be a reference document detailing Hisoft Pascal 4T. It does however contain the syntax diagrams so if you want to know whether Goto is supported, just look it up under Statement.

HCCS's manual has the immediate advantage of giving an example you can type in, in immediate mode, so that you can see something happening before you have got to the end of page 3. It is not until a short while later that you realise that immediate mode Pascal is a bit of a waste of time if, as happens, you have to retype the whole program if you make a mistake.

When you have loaded Hisoft's Pascal do not hold your breath – cassettes take time. You will find you have to wander through the manual until you finally get something into your Spectrum around page 40. And that is only when you have mastered the complex editor. The next problem that befalls you is that if you compile a program the Spectrum asks you if you want to translate it. If you say yes your compiler is deleted and you have to reload it.

HCCS's compile and run techniques and disc filing system are much better and easier to use and, generally speaking, conform quite closely to UCSD Pascal. There is, though, one serious limitation with HCCS's Pascal. That is that you cannot do more than 32 lines at a time. Is this the ultimate incentive for modular programming?

Of the two, HCCS's Pascal is far easier to use, but you would expect it to be – with ROM and disc based filing it would be rather damming if a cassette version turned out to be better. Hisoft's Pascal is good in theory, but rather laborious in practice. Neither compiler or interpreter are particularly fast, and sadly this may well leave people happy to plug on with tired old Basic. It may be hard to make people see the real beauty of Pascal but it is a great language, believe me.

Piers Letcher

FORTH

Acornsoft Forth is currently supplied on tape or disc and a cartridge version is on the way.

With Forth loaded you are left with just over 20K of memory free. The maximum screen mode supported by the system is modes 4 and 5 requiring 10K; leaving about 9K for user applications. If the editor is required this takes 2.5K. However Forth is much more efficient in its use of memory than Basic.

Forth supports its own operating system for handling the users and the backing store interfaces. Calls can be made to the Machine Operating System by prefacing them with the Forth word OS'. So OS' *CAT will work in the same way as the catalogue command given from any other environment. Unfortunately the system can become confused and on exiting from the catalogue using the escape key, control is sent back to Basic not Forth. This is, at worst, irritating and potentially disastrous as any attempt to issue a Forth command which could be interpreted as a Basic line ie., any command prefixed by a number, will be stored as a Basic line. This makes re-entry to Forth impossible, and causes a delay of another 10 minutes to reload Forth the editor and any applications

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problems, you can put features in the language that actually help people think. The emphasis for the programmer shifts from worrying about how the machine is going to solve a problem to how to actually think about it in the first place.

You can have languages with a special bias towards a particular type of application — which goes some way to explaining why there are probably at least 200 languages in common use today.

Another important advantage of high level languages is that the programs are largely independent of the particular hardware used, unlike machine language. The first major high level languages for non-scientists and engineers was Cobol, which has become the world's most successful commercial language largely because efforts were made to keep it machine independent. Cobol stands for COmmom Business Oriented Language.

Cobol, Fortran and Basic are all still heavily used because languages develop. Old languages never die, they are just extended.

Without standardisation a large market for software packages cannot develop, as only a small proportion of the machines in existence will be able to run a program written in any particular dialect of the language so eventually a big meeting is held to thrash out a new up-to-date definition of the language.

Cobol has flourished as a language mainly because the US Department of Defense took responsibility for enforcing standardisation from an early date, so there are few competing dialects.

Basic has gone through this process of growth perhaps more than any other and suffers from widely differing dialects. Many of its core features were copied directly from Fortran — For / Next loops and the way calculations are specified for example. But Fortran had poor string handling so designers of Basic had no obvious model.

In fact, string handling is where the biggest differences between Basic dialects now lie. There are two major approaches. Most microcomputer Basics allow only short strings, typically of less than 255 characters in length, and use the Left$, Right$, Mid$ functions to select sub-strings.

Most versions of Basic running on the large DEC, Hewlett-Packard, and IBM mini-computers, on the other hand, as well as Sinclair Basic, are closer to the American National Standards Institute ANSI guidelines, and allow very long strings and use a syntax where "Example" [3,5] specifies the substring "Amp".

Most microcomputer Basics can be traced back to the Basic written for the MITS Altair microcomputer — probably the first micro — by Bill Gates in 1975. His company, Microsoft, has gone on to write the Basic for many newer machines and these all have a family resemblence. The Microsoft style of Basic has been widely copied by other companies so a vague standard has emerged without formal agreement. But there is always the temptation to add wonderful new commands, like the Oric's Zap and Ping, which Kemeny and Kurtz would not recognise.

Even worse, Peeks and Pokes to take

advantage of a particular machine's sound and graphics abilities lead away from a common, readable Basic back in the direction of machine language. There can be no doubt that Basic is a very good language, just because its simple, usable, and friendly structure can survive all this mutilation. But at a certain point it may make sense to change to another language.

Forth is currently in vogue and it shares the

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ORIC

FORTH

Oric Forth from Tansoft offers standard Fig-Forth, a screen editor, an assembler and various extensions to take advantage of the sound and colour of the machine.

Screens and an editor are used in preference to the listing system of the Jupiter Ace. These are Forth-standard and make the language more portable.

The core is standard Fig-Forth and offers all the usual words with one or two additions. Forth-Save allows the saving of the full dictionary without all the fiddling with start addresses or number of bytes to worry about.

The editor is next on the tape and occupies seven 1K screens. This allows programs to be listed and edited before they are loaded into Forth itself and are executed. The assembler is only five screens long and offers all the 6502 mnemonics and tokens in order to create machine-code primitive Forth words.

Seven screens of extensions offer such facilities as VDU I/O, random numbers, the creation of arrays, the use of Case – a programming technique borrowed from Pascal, and all the Basic graphics and sound commands retranslated into Forth.

Finally on the tape is Tunesmith, a music-playing program from Paul Kaufman which makes entering a tune in three-part harmony much easier than it is in Basic. All this is accompanied by a useful manual with full listings of the Forth words and what they do.

David Scobie

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hierarchically organised so that modules doing more detailed things nest within more general modules.

This all helps when you are writing large programs, so Pascal has turned out to be very important commercially, but I think it is unlikely to catch on for entertainment. Pascal is a compiled language, which means that your high level instructions are not converted to machine code until you have completed the whole program or chunk of program, unlike Basic, which is generally converted line by line as you type it in. This makes changing a tiny bit of a Pascal program tedious and time consuming by comparison.

Another reason Pascal is unlikely to become more than a minority microcomputer language is that the original academic thoroughness of its design makes extending the language in a quick and nasty way *à la* Basic rather difficult.

Logo has a great future in micros. It again has academic origins, but the academics who designed this one in the late 1960's, Seymour Papert, Daniel Bobrow and Wallace Feurzeig of MIT, had a lighter touch. They were thinking initially of young children and how they come to understand visual and spatial ideas.

Turtle graphics, where you draw on the screen by giving movement orders to an imaginary turtle, is the most obvious result of this thinking in Logo. You can now get versions of other lanugages that have had turtle graphics added as a non-standard extension.

Logo's real strength is the way it holds data in with the descriptions of how you manipulate it in the main part of the program. Basic, for instance, is quite limited in the way it gets you to think about data, with string and numeric variables which are just like pigeon holes, and arrays that are just like tables.

The Logo model is more useful for manipulating non-numeric textual data in the way home programmers most often want to do it and could end up being the language used for expert systems at the popular level.

Many Logo features are taken over from Lisp, which although an earlier language dating back to 1960, is still going strong in the artificial intelligence community. The language was designed especially for manipulating non-numeric data, which it does by organising the data as lists. The name Lisp is derived from List Processing language.

Lisp itself will never gain mass popularity because of its syntax. The way you write it involves enormous numbers of brackets, the clerical task of counting to make sure you have the right number of brackets, matched up properly, is a pain.

BCPL is a much more recent structured language widely used in universities as an alternative to assembler or machine code. I have had no contact with it, but the article by David Simpson in this issue describes the newly released version of the language for the BBC computer.

Although any language is more suited to some tasks than others all the languages I have mentioned so far are quite general purpose. As long as a language is rich enough in the kind of way it lets you hold data and the way it lets you control I/O devices, you can write virtually anything in it.

Again it makes little sense to talk about good and bad languages unless you say what tasks you are trying to program and what your idea of a good outcome is — compact code, rapid execution, easy and fast programming, beautiful looking output, an enjoyable time programming, or whatever. I am fairly confident I could write space invaders in Cobol, a long tedious language for such a purposes. The graphics would not be much good but you could zap character blobs coming down the screen at you.

Basic would clearly be better, and Forth or C would be ideal. Machine language would of course be capable of producing an excellent game, but the job would take longer and demand more detailed knowledge of the particular system. What is best depends on what you want to optimise. It is horses for courses.

So what will happen in the future? Basic will keep mutating. The only real challenge in the mass market I think will be Logo, just because it is going to get into the schools and it is good for graphics and it is easy to make extensions to it to take account of new computer features like sound or speech.

In the longer term what matters is helping people to think, as with memory prices falling and processor power going up languages designers will have to think less and less about efficency on the machine. There will probably be more languages — personal taste will matter even more.

People will choose a language which gives them metaphors for thinking about the things they are trying to program. It will not be the case that programming languages will disappear, to be replaced by some automatic way of controlling machines, because programming is too enjoyable. And it is only partly about control — it is also a thought extension. ■

SPECTRUM FORTH

Abersoft 48K Spectrum Forth – with graphics – impressed me almost as much as the Sinclair Forths. This loaded in just 70 seconds, including the editor. This is a Fig-Forth implementation with extensions to make best use of the Spectrum capabilities.

All the Forth standard words are included and a better selection of double-precision operators. The Spectrum specific extensions include graphics words such as, Draw, Attr and At but apparently no Circle. All these words are the same as their Basic synonyms. Beep is not the same as Spectrum Basic Beep.

Its two parameters are related directly to the machine-code loops, allowing the sound to be more creative if less easy to use than Basic. User-defined graphics conversely are easier to construct.

There are two ways to Save definitions both of them non-standard. The first of these is a routine to Save the Forth nucleus definitions and your definitions in the same form as the system is supplied in. This is non-standard but a good idea.

The other method involves 10 standard Forth screens. Each screen can be compiled individually, but can only be transferred to and from tape as a group of 10 screens. Abersoft promises Microdrive file support in the near future. Hopefully this will allow the screens to be individually numbered and the filing operations to be carried out automatically.

The Forth screen editor is again a standard Forth editor. The presentation of the screens on the VDU is a little different. It is usual for a Forth screen which conventionally consists of 16 lines of 64 characters to be presented as 16 blank lines. This allows the whole Forth screen to be visible on the VDU screen. This editor initially presents each line as 64 question marks: causing it to spread off the screen.

This is inconvenient but Forth is friendly and flexible, a dangerous word can be defined which puts a carriage return only onto each line.

Also included is a printed booklet which includes the usual introduction to Forth, loading details and a glossary.

Fintan Culwin

VIC FORTH

There is a certain something about products associated with the language Forth. The people involved seem to make the extra special effort that gives their product the edge over others.

It arrives in two parts: a cartridge with the language, and extra memory, packaged neatly and concisely with explicit instructions about what to do and a clear and well-written manual, suffering only from being a little flimsy, but the content is excellent.

MSX BASIC

Bill Gates, right, wrote the first modern microcomputer Basic in 1975. Now his company, Microsoft, is ready to launch MSX Basic and Graham Bland explains its importance.

SO WHAT MAKES MSX-Basic so special? A standard, termed MSX, was proposed by ASCII Microsoft in Japan and was adopted by 15 companies in the consumer electronics field. MSX backers include such home entertainment luminaries as Sony, Yamaha, Sanyo, JVC, Pioneer and Spectravideo in the United States.

The standard outlines specifications for a home micro system, the hardware and software that will define an MSX machine. No new ground is broken as far as the hardware is concerned: the old Zilog Z80 workhorse is the processor of the system, and support chips include Texas Instruments' 9918 video display processor, and the AY-3-8910 sound chip. MSX-Basic comes as part of the machine and is resident in 32K of ROM. The initial RAM supplied will be 8K, but both RAM and ROM will be extendable.

What this in effect proposes is that the basic configuration of all MSX computers will be the same. Support for I/O devices, graphics and sound will be handled in precisely the same manner from one manufacturer's system to another. Software compatibility will obviously make software producers happy. Instead of targetting their products for one micro, or simply tailoring software for a range of micros, there will be a large number of machines to run a single item of software.

MSX products are aimed at the area of the market now occupied by the Sinclair ZX Spectrum. Although there is a plethora of software for just about any application available, to gain access to it you are still stuck with the cosmetic inadequacies of the Spectrum — the word keyboard looms very large. With MSX, if you do not like the look of one manufacturer's offering, you can always go for another. The existence of a large software base is guaranteed.

MSX-Basic finds its roots in Microsoft's hugely successful MS-Basic, and incorporates the features of GW-Basic, which runs on the IBM PC, plus numerous enhancements over its predecesors. Programmers familiar with the Apple II and IIe Basic will find the transition to MSX-Basic painless, and those whose initiation has been on the Spectrum will find that the language offers so much more, particularly in the area of graphics and sound.

It is important that any graphics commands should be instantly accessible, as this is the feature which is probably most rewarding for the first-time user. In MSX-Basic, there are three screen modes available: a text screen, low and high-resolution graphics. These screens may be used with the range of 16 colours provided — the Spectrum has half this number — with the usual ability to specify foreground, background, and border colours.

The high resolution screen is 256 by 192 pixels. Each pixel may be addressed individually using the Pset and Preset commands, which respectively turn a pixel on and off. Commands to draw shapes such as circles and boxes are also provided. The Circle statement is very similar to the Spectrum's, but it offers options to draw any elipse you care to specify.

Drawing a line is again much the same as Sinclair's Basic, but with an optional pair of switches at the end of the statement, one of which draws a rectangle, the other drawing a rectangle and filling it in with a specified colour.

A new feature, shared both by the graphics and sound capabilities of the language, is the concept of macro language. These are languages beneath the Basic which allow character strings to define shapes or patterns of notes. The graphics macro language allows any shape to be defined and displayed on the screen using the Draw statement. A simple example is the drawing of 20 by 40 rectangle, which may be achieved by using the following statement in graphics mode:

```
10 DRAW "U40 R20 D40 L20"
```

As you may have guessed, U40 means move up 40 pixels, R20 means move right, and so forth.

Once a picture has been drawn, it can be

(continued on page 86)

This package saves you the frustration of loading cassettes and enables you to dive straight in. The designers have obviously thought long and hard about what they are doing, and this is immediately apparent when you start to read the manual.

Your Forth program has been divided up into screens. You always know where you are as you are told in the bottom left hand corner. Each has a width of 64 and height of 16 giving you 1K at a time to play with. This sounds like a lot of memory at each go but Audiogenic have been sensible enough to put in a powerful screen compression routine.

A blank screen compresses to five bytes including the screen number. When you arrive you are in Screen 0. This is the interpreter screen so anything you type in at first will be interpeted. The screen editor is easy to use and well described in the manual so you can go straight on to the part where you write your program — Screen 1 and following.

The manual has supposedly been written for people with prior knowledge, but if you have mastered one programming language you could plug in this and start to program in Forth.

Forth is a strange beast; there are no reserved words at all, the only rule being that the reserved words which you define can only use words that have been previously defined. So nobody's Forth program ever looks quite the same as anyone else's. It also makes other people's Forth programs hard to understand.

If you want to program in Forth on your Vic-20, Audiogenic has come up with a real quality product. Forth is generally thought of as being a specialist's language. However, it is extremely fast compared to Basic — and is a lot easier to use than machine code since you can define your functions, starting simply and working up.

It does, unfortunately, lead to the most unreadable programs I have seen — you certainly could not expect to debug someone else's program, and it is not easy to debug your own. Nevertheless, this implementation is the best I have used.

Piers Letcher

(continued from page 85)
read from the screen into an array using the Get statement. Pictures held in this way can be redrawn on the screen using the Put statement. This is an extremely fast way of refreshing screen images and has the potential to provide some very exciting animation, without having to go to machine code. In addition, a full range of commands are provided to create and control graphic sprites.

For people who like to have their micro greet them with Land of Hope and Glory, the music support of MSX-Basic will appeal. The simplest statement is Sound, which plays a note of a given pitch and duration. Most people would feel happier dealing with musical terms they understand. Rather than dealing with music in terms of numbers, MSX-Basic allows notes to be defined as letters in the musical scale. Sharps and flats are denoted by + and - respectively. A sequence of notes may be played in the background, that is, stored in a buffer allowing for faster Basic execution times. The following example plays all the notes of an octave:

```
10 PLAY "C C+ D D+ E F F+ G G+ A A+ B"
```

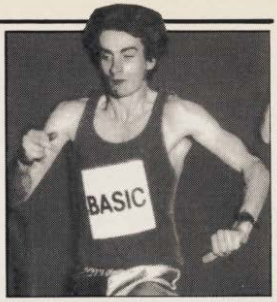
Rests and other information can be included in the music string, such as the tempo the music requires, and whether or not a note is to be played legato or staccato.

Most of the spacewar games would be far less interesting if the program relied on the keyboard. The MSX machines will have a full range of connections for joysticks, games paddles and touchpads, all of which are fully backed up by functions in the Basic. The standard If and Goto statements are supplemented by code which will allow a jump to a subroutine whenever a button on a joystick is pressed.

This obviously saves Peeking a memory location to see if the event has occurred. Perhaps the experienced do not mind milling about at the machine level, but the novice will appreciate this shielding from the very nasty world of programming in numbers.

MSX-Basic excels in its elegance: Peek, Poke and USR functions are there to be used when absolutely necessary, but where possible, a new feature has been provided to avoid calls to the machine code. For those programs which require an endless sequence of If . . Then . . Goto statements, the programmable function keys may help in entering such code.

Up to 15 characters may be assigned to each soft key. All that needs to be done is to program keys with the most repetitive parts of the statement, and use these keys to enter the program. This takes Sinclair's one key Basic a step further — you can have the facility if you want it, but it will not plague you if you do not.



In conclusion, the language seems to have been designed with the fun element of programming in mind. Everything that is expected of a Basic language is as it should be, and is laid out in such a way that the enthusiastic newcomer will be "talking" to the machine in no time at all.

Unfortunately, if you want to get your hands on an MSX computer, you will have to wait. The first machines should be on the market for Christmas. ■

Machine	Language	Company	Price
BBC	Forth	Acornsoft	£19.90
	Lisp (disc)	Acornsoft	£19.90
	BCPL	Acornsoft	£99.95
	Pascal	HCCS	£67.85
Spectrum	Forth	Sinclair	£14.95
	Forth	Abersoft	£14.95
	Pascal	Hisoft	£25.00
ZX-81	Forth	Sinclair	£14.95
	Forth	Artic	£14.95
Dragon	Forth	Oasis	£18.95
	Forth	M&J Software	£9.95
	Vic-20		
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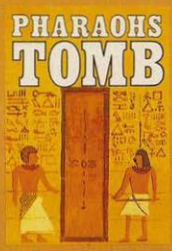

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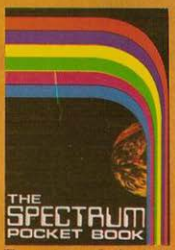

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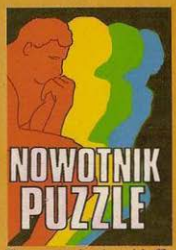
The traditional game with superb screen presentation. Score points by making the two ends add to a multiple of five or three. The first one to reach 72 points wins. **£4.95**



The computer breaks and shuffles a two by two coloured square, whilst you watch the moves it makes. You must then unscramble it to reassemble the original squares. Machine coded. **£4.95**

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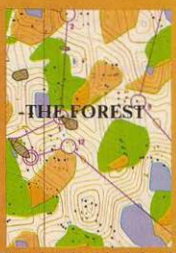
To find the Black Planet you need 7 pieces of the key each hidden on different planets, and needing different puzzles to be solved. On the way, you fight off the pirates who get steadily more desperate. **£5.95**

You are Spectrasses, battling in the arena with Gorgon, whose stare can turn you to stone. To recover the lost chalice, you must also win a swordfight with Grang, inside his cave. **£4.95**



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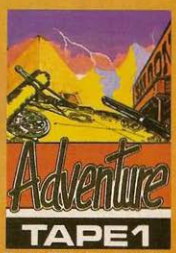

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VISA

```
   1 REM for £ read hash character
   5 CLEAR 30460: PAPER 0: INK 7: BORDER 0: CLS : POKE
 23676,127
  10 PRINT """CAPMAN!"" BY ANDREW CAPLE 1983": INK 3:
PLOT 128,0: DRAW OVER 1;0,155,2771*PI: INK 7: PRINT AT
 11,11; FLASH 1;"COMPILING!"
  15 FOR F=0 TO 15: READ A$: LET A$="LLLLLL"+A$+"LLLLL
LL": FOR G=0 TO 31: POKE (32000+32*F+G),CODE A$(G+1)-6
5: NEXT G: NEXT F
  20 LET A=10: LET B=11: LET C=12: LET D=13: LET E=14:
 LET F=15: LET A$="£"
  25 IF A$="£" THEN READ AD: LET A$=""
  30 IF A$="" THEN READ A$
  35 IF A$="$" THEN GO TO 300
  40 POKE AD,16*VAL A$(1)+VAL A$(2): LET AD=AD+1: LET
A$=A$(3 TO ): GO TO 25
  60 DATA "LLLLLLLLLLLLLLLLLLLL"
  61 DATA "KKKKKKKKKKKKKKKKKKKK"
  62 DATA "KUTTTTTTTTTTTTKTTUK"
  63 DATA "KTKTKKKKTKKKKTKTKTK"
  64 DATA "KTKTTTTTTKTTTTTTTTK"
  65 DATA "KTKKKKTKTTTKTKKKKTK"
  66 DATA "KTTTTTTKKKKKTTTTTTK"
  67 DATA "KKKTKTKKRRRKKTKTKKK"
  68 DATA "KTTTKTSSSSSSSTKTTTK"
  69 DATA "KTKTKTKKKSKKKTKTKTK"
  70 DATA "KTKTKTTKKKKKTTKTKTK"
  71 DATA "KTKTKKTKTTTKTKKTKTK"
  72 DATA "KTKTTTTTTKTTTTTTKTK"
  73 DATA "KTKTKTKKKKTKKKKTKTK"
```

CAPMAN IS A version of the popular arcade game Pacman and is written to run on a 16K Spectrum. The program will run on a 48K Spectrum through memory will be just as cramped. This is because the machine code is located at the same address as on the smaller machine. The features of the program are:

- Fast machine code action.
- Intelligent ghosts.
- 10 levels of play.
- On-screen scoring.
- Personalised high score.
- Mouth opens and closes in the direction of travel.
- Two melodies.
- Colours.

The program is self-contained so the listing given is the only one needed. The hex-code, hex-loader, maze data and Basic control program are stored in the one routine. This method was adopted to prevent messing about Saving the code separately to the control program. The disadvantage of this program is that an enormous amount of program area is used up by the hex-digits, so in effect a machine-code routine will take up more than three times its length. Before you start typing in the listing unplug your Spectrum then reconnect it, this ensures that you have the maximum amount of memory dedicated to the listings.

```
 74 DATA "KTTTKTTTTTMTTTTTTTK"
 75 DATA "KKKKKKKKKKKKKKKKKK"
110 DATA 31232,"E5D5C54F067F7CD623670A777CD658878787F
6406779878787C6585F167F06081A772413 10FAC1D1E1C9E"
121 DATA 31280,"21007B7CFE7DC87ECD007A2318F5E"
131 DATA 32512,"383838383838383838080203E3E3E3E3A3
838BAE"
141 DATA 32680,"FFE7C39999C3E7FF0000000000000000187E3
E0F0F3E7E18187E7EFFE7664200004266E7FF7E7E18187EFCF0F0F
C7E18187E7EFFF7E7E183C7EFF99BD99FF99000000000000000
00000181800000000054387C385400E"
151 DATA 31296,"21007D01007B7E02230378FE7DC818F6E"
161 DATA 31312,"E521237F180BE521247F3A257F3C32257FE5D
521000211800CDB503D1E17E3CFE0A380536002B18F577E1C9E"
171 DATA 31360,"213F7D1247F06041ACD007A1B2B10F8C9E"
181 DATA 30976,"FFFF2000E0FF01002A267F7E1128503A297
FEE0132297F3A287FFE002804 3D32287F3E1277CD007A3A085CD63
53830FE04302C322A7F8716795F1A4F131A47"
182 DATA "097EFE113005 2A267F1815FE132005CD567A180CFE1
42008CD567A3E2032287F3A297FFE0120043E041B033A2A7FC60C2
2267F77CD007C9E"
191 DATA 32544,"000000000000D07C000000EE7B0212EF7B021
2F07B0212FF000000000000000E"
201 DATA 31384,"0604783D876F26785E2356DD6E00DD6601197
EFE0C300310E9C9FE11D818F2E"
211 DATA 31424,"212B7F06035E3EED807723536367B233602237
E3612122310EC2A267F7EFE133B03CD567A361221D07C22267F360
C060321EE7B36112310FBCD307AC9E"
221 DATA 30720,"E0FF01002000FFFFDD212B7F3EFC32117FDD6
601DD6E007EFE112828DDE5CD507ADDE1DD7E03FE133807DDE5CD5
67ADDE121ED7B237EFE1220FADD36020DD3603121851"
222 DATA "DD7E0377CD007ACD987A7B06033CFE012003DD7E02E
603DD7702052803ADD7E02B76F26785E2356DD6E00DD6601197E"
223 DATA "FE12301B78FE02200F3A785CE601DD7E022802C6023
D18CEDD7E02C6021BC3DD7703DD7500DD7401DD6601DD6E003E117
7CD007A"
224 DATA "0604DD2310FCDD7E00FEFFC2117BC3D577E"
231 DATA 30464,"DD212B7F3E3A32117FDD6601DD6E007EFE112
808CDC07AAF32387FC9DD7E0377CD007ACD987A7B06033DFEFF200
3DD7E02E603DD7702"
232 DATA "052B3EDD7E02876F26785E2356DD6E00DD6601197EF
E112804FE0C301B78FE02200F3A785CE601DD7E022802C6023D18C
A"
233 DATA "DD7E02C6021BC3DD7703DD7500DD7401DD6E00DD660
13E1177CD007A"
234 DATA "0604DD2310FCDD7E00FEFFC20977C3D577E"
241 DATA 30624,"21247F06043600 2B10FBAF32257FCDC07ACD4
07ACD307ACD0879CDB07A3A257FFE7E2006 3E013238 7FC93A287FF
E00C20878C3007706FFC506FF10FEC110FB1B D6"
```

Note: Line 540 should read:

```
540 PAPER 7: FOR F=0 TO 2: LET
L=9+5*F: PRINT AT 12,L;"■■";AT
13,L;"■A■";AT 14,L;"■■": NEXT F
: PAPER 4
```

As the program pushes the 16K Spectrum to its limits do not lower RAMtop until the entire listing has been entered. Once you have finished keyboard bashing Save and Verify the program. This must be done as it is almost certain that on running the program for the first time it will crash. If it does then do not take it out on your Spectrum, just re-Load, correct any mistakes, re-Save it, Verify it and try again. Once you have a perfectly running version type:

SAVE "CAPMAN" LINE 5 [ENTER]

then verify it. This will give automatic running on Loading. If you get to this stage without having a nervous breakdown give your self a pat on the back and look smug.

All this messing about is the price you have to pay for the smooth fast graphics of machine code. On running the program the titles appear and the compiling message will be printed. While this is flashing the computer is setting up the maze and Poking the machine code onto its appropriate position in memory. Do not worry, you do not have to wait this long between games — it is only on running from the start that this happens. Once compiling is complete you are played a famous movie theme tune. Then the following prompt appears:

SPEED

This will accept a single decimal digit ie., 0 to 9, nine is the fastest and zero the slowest. Enter your number and get your fingers at the ready! Various items of data will appear on the screen and then the game leaves the safety of Basic and jumps into the high speed, tight-rope-like world of machine code. The object of the game is to score as many points as possible by eating dots, stars or ghosts. You do this by moving the little yellow mouth about the maze. The ghosts must be avoided when they are red but can be eaten when they are flashing green. If you eat a star the ghosts will change to flashing green, but only for a short time.

Try your hand at Andrew Caple's machine code-based Pacman derivative. But be careful; it is fast and furious and the monsters are particularly vicious.

```
300 CLEAR : LET A$="ABCDEFGHIJKLMNOPQRSTUVWXYZ ": LET
C$="    ": LET H$="XXXXXXXX"
310 FOR F=0 TO 79: POKE 32600+F,PEEK (15744+F): NEXT
F
400 BORDER 4: PAPER 4: INK 0: CLS
410 LET L=USR 31296: LET L=USR 31280
420 RESTORE 9910: GO SUB 9000
430 INPUT "SPEED ";E: LET E=INT E: IF E<0 OR E>9 THEN
GO TO 430
440 POKE 30678,255-16*E: PAPER 7
450 PRINT AT 17,0;H$(4 TO );" = HIGH SCORE    SCORE =
0000";AT 19,6;"HIGH SCORE BY : ";H$( TO 3);AT 21,10;"L
IVES = ";: FOR F=1 TO 3: PRINT CHR$ 156;: NEXT F
460 PAPER 4: LET L=3: LET X=USR 30624
470 IF PEEK 32568=1 THEN BEEP .5,17: FOR F=1 TO 100:
NEXT F: LET X=USR 30634: GO TO 470
480 RESTORE 9900: GO SUB 9000
490 LET L=L-1: PRINT AT 21,18+L;" ": IF L<>0 THEN LET
X=USR 30644: GO TO 470
510 FOR F=1 TO 4: LET C#(F)=STR# PEEK (32544+F): NEXT
F
520 FOR F=1 TO 200: NEXT F: IF C#<H#(4 TO ) THEN GO T
O 600
530 CLS : PRINT AT 3,9;"NEW HIGH SCORE";AT 5,6;"INPUT
 YOUR INITIALS";AT 7,0;"ADVANCE EACH LETTER WITH KEY "
"8""";AT 9,2;"SET EACH LETTER WITH KEY ""0""
540 PAPER 7: FOR F=0 TO 2: LET L=9+5*F: PRINT AT 12,L
;"";AT 13,L;"A";AT 14,L;"": NEXT F: PAPER 4
550 FOR F=0 TO 2: LET G=1
560 IF INKEY$="8" THEN LET G=G*(G<>27)+1: PRINT AT 13
,10+F*5; PAPER 7;A#(G)
570 IF INKEY$="0" THEN BEEP .3,20: LET H#(F+1)=A#(G):
NEXT F: GO TO 590
580 FOR A=1 TO 50: NEXT A: GO TO 560
590 LET H#=H#( TO 3)+C#
600 FOR F=1 TO 200: NEXT F: CLS : PRINT PAPER 7;AT 11
,11;"GAME OVER"
610 IF INKEY$<>"" THEN GO TO 410
620 GO TO 610
9000 READ A: READ B: FOR F=1 TO A: READ C: READ D: BEE
P C/B,D: NEXT F: RETURN
9900 DATA 11,10,2,0,2,0,1,0,2,0,2,4,1,2,1,2,1,0,1,0,1,
-1,3,0
9910 DATA 43,5,1/3,2,1/3,2,1/3,2,2,7,2,14,1/3,12,1/3,1
1,1/3,9,2,19,1,14,1/3,12,1/3,11,1/3,9,2,19,1,14,1/3,12
,1/3,11,1/3,12,2,9
9920 DATA 2/3,2,1/3,2,2,7,2,14,1/3,12,1/3,11,1/3,9,2,1
9,1,14,1/3,12,1/3,11,1/3,9,2,19,1,14,1/3,12,1/3,11,1/3
,12,2,9,1,14,7,19,1/3,19,1/3,19,1/3,19,1/2,19
```

To enter the Capman the Capman flashing green on bright white, look very ill and scurry off down the corridors of the maze as fast as their pixels will carry them. Flashing green was chosen so that it is clear to people using black and white televisions. A straight colour change from red to green is not easily recognised in monochrome.

On eating a ghost — this can only be done when you are energised — you get 10 points and the ghost will appear in the centre of the maze. If you eat the last dot or star the positions of the Capman and the ghosts are reset and the maze fills up again. If you try to eat a ghost when it is red or a ghost eats you the computer will reset positions, play a near enough version of the Death March and a life will be deducted. If you have a life left, remember you have three in all, the game continues. The ghosts are pretty intelligent but they can be gullible chappies at times. When you are energised they will try to run. Sometimes they stop at corners and panic but on the whole they are not very easy to catch. When red they protect the power stars and try to seek you out and eat you. Once one is on your tail it is hard to shake it off. When you have run out of lives the computer will see whether or not you have attained the highest score so far. If not a short delay will be followed by the game over message. If any key is pressed another game will commence. There is provision for three initials but if you only have two there is a space provided at the end of the alphabet. Lo and behold on the next game your score and initials will appear on the screen. ■

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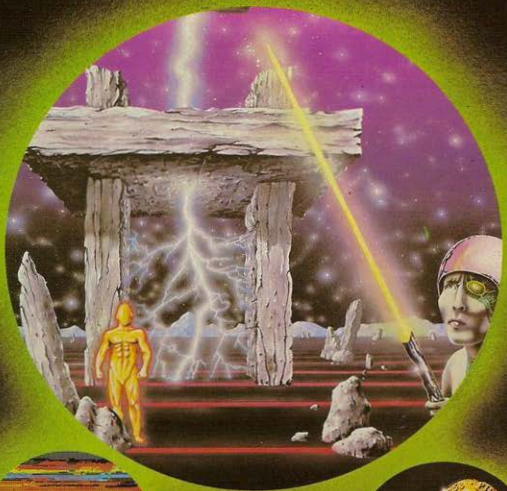

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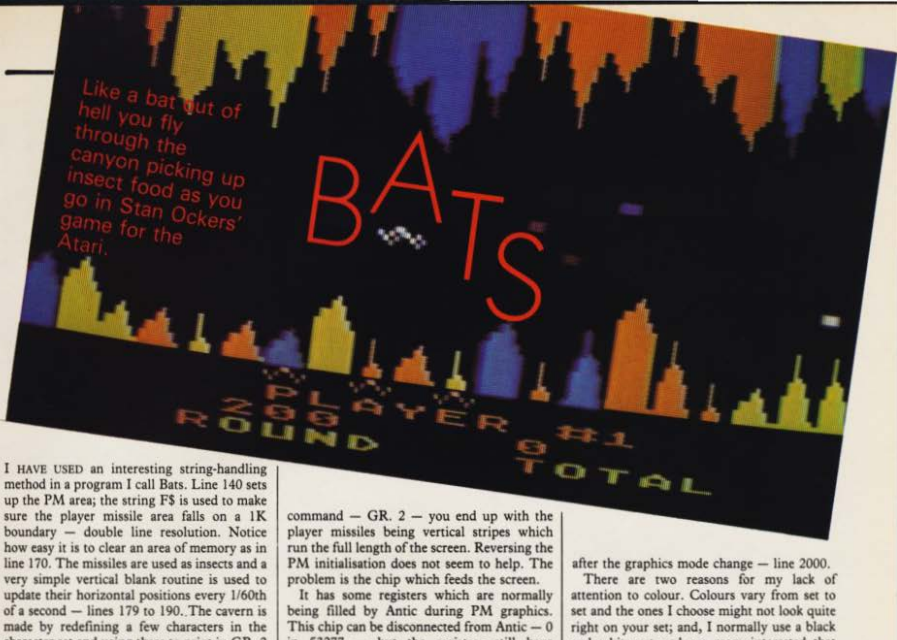

I HAVE USED an interesting string-handling method in a program I call Bats. Line 140 sets up the PM area; the string F$ is used to make sure the player missile area falls on a 1K boundary — double line resolution. Notice how easy it is to clear an area of memory as in line 170. The missiles are used as insects and a very simple vertical blank routine is used to update their horizontal positions every 1/60th of a second — lines 179 to 190. The cavern is made by redefining a few characters in the character set and using these to print in GR. 2 mode.

This program handles a problem which has bothered me for some time. If you once initialise PM graphics and then do a Graphics command — GR. 2 — you end up with the player missiles being vertical stripes which run the full length of the screen. Reversing the PM initialisation does not seem to help. The problem is the chip which feeds the screen.

It has some registers which are normally being filled by Antic during PM graphics. This chip can be disconnected from Antic — 0 in 53277 — but the registers still have information in them which results in the vertical lines. These registers — 53261 to 53264 — have to be cleared with Pokes as in line 1000. PM graphics is then reinitialised after the graphics mode change — line 2000.

There are two reasons for my lack of attention to colour. Colours vary from set to set and the ones I choose might not look quite right on your set; and, I normally use a black and white set and am more interested that things show up well in black and white. I have just used the default colours in Bats and there is plenty of room for improvement. Playing instructions are included in the program.

```
20 REM ********************
30 REM **      BATS      **
40 REM ** BY STAN OCKERS  **
50 REM ********************
100 DIM ZZ$(32):FOR I=1 TO 32:READ A:ZZ$(I)=CHR$(A):NEXT I:GOSUB 32000
:CLR
102 DATA 104,104,133,204,104,133,203,104,133,206,104,133,205,162,4,160
,0
104 DATA 177,203,145,205,136,208,249,230,204,230,206,202,208,240,96
110 GOSUB 3000
130 TRAP 130:? "# PLAYERS ";:POKE 764,255:INPUT NP
138 REM ** PM GRAPHICS **
139 REM ** SEE MAR '82 SOFTSIDE P. 69 **
140 DIM D$(1),F$((INT(ADR(D$)/1024)+1)*1024-ADR(D$)-1),PM$(384),M$(128
),P$(128),MM$(8)
150 RESTORE 160:FOR I=1 TO 8:READ A:MM$(I)=CHR$(A):NEXT I
160 DATA 3,3,12,12,48,48,192,192
170 PM$=CHR$(0):PM$(384)=CHR$(0):PM$(2)=PM$:M$=PM$:P$=M$
172 REM ** MISSILE COLORS **
174 POKE 704,14:POKE 705,39:POKE 706,54:POKE 707,70
179 REM ** VBI ROUT. TO MOVE MISSILES **
180 FOR I=1536 TO 1566:READ A:POKE I,A:NEXT I
190 DATA 104,160,14,162,6,169,7,76,92,228,90,120,150,180,162,3,222,10,
6,189,10,6,157,4,208,202,16,244,76,98,228
199 REM ** BAT IMAGES **
200 DIM BATDN$(5):BATDN$=P$:FOR I=2 TO 4:READ A:BATDN$(I,I)=CHR$(A):NE
XT I
210 DATA 24,165,66
220 DIM BATUP$(5):BATUP$=P$:FOR I=2 TO 4:READ A:BATUP$(I,I)=CHR$(A):NE
XT I
230 DATA 66,165,24
250 POKE 54279,ADR(PM$)/256:POKE 559,46:POKE 53277,3:POKE 623,4:A=USR(
1536)
259 REM ** STALACTITES AND STALAGMITES **
260 DIM C$(42),U$(42):C$="******%%******":U$="):(*****'*****":FOR I=1
TO 14:C$(I*14)=CHR$(ASC(C$(I))-32)
270 U$(I*14)=CHR$(ASC(U$(I))-32):C$(I*28)=CHR$(ASC(C$(I))+128):U$(I*28
)=CHR$(ASC(U$(I))+128):NEXT I
272 DIM P(NP),SCORE(NP),TOTAL(NP),BN(NP),BONUS(NP)
275 W=7:P=0:POKE 82,0
278 FOR I=1 TO NP:SCORE(I)=0:TOTAL(I)=0:BN(I)=3:BONUS(I)=1000:NEXT I:N
XTCV=300:NP
279 REM ** CHANGE WIDTH OF CAVERN **
280 IF W>3 THEN W=W-1
282 GOSUB 480
284 P=P+1:IF P>NP THEN P=1
286 IF BN(P)=0 THEN 284
287 M$=PM$:FOR I=0 TO 3:M$(YST+5*W+W*(3-I))=MM$(2*I+1,2*I+2):NEXT I
289 REM ** MAIN LOOP **
290 POKE 656,1:POKE 657,22:? " Pull Joystick"
295 IF STICK(0)<>13 THEN 295
299 REM ** SCORECARD **
300 ? CHR$(125):GOSUB 700:POKE 656,0:POKE 657,26:? "PLAYER #";P
301 POKE 656,1:POKE 657,24:? "Round   Total";:GOSUB 860
306 POKE 5324B,30:YPOS=YST+20:POKE 53278,0:T=0:DIS=12
310 FOR XPOS=47 TO 200:POKE 5324B,XPOS:IF STRIG(0)=0 THEN YPOS=YPOS-1:
P$(YPOS)=BATUP$
320 IF STRIG(0)=1 THEN YPOS=YPOS+1:P$(YPOS)=BATDN$
330 IF PEEK(53256)>0 THEN POKE 1546,0:TOTAL(P)=TOTAL(P)-100:GOTO 420
340 IF PEEK(53257)>0 THEN POKE 1547,0:GOSUB 900
350 IF PEEK(53258)>0 THEN POKE 1548,0:GOSUB 900
360 IF PEEK(53259)>0 THEN POKE 1549,0:GOSUB 900
370 IF PEEK(53252)>0 THEN 420
390 NEXT XPOS:P$=PM$
395 IF SCORE(P)<300 THEN 306
400 TOTAL(P)=TOTAL(P)+SCORE(P):SCORE(P)=0:GOSUB 870
402 IF TOTAL(P)>BONUS(P) AND BN(P)<4 THEN BONUS(P)=BONUS(P)+1000:BN(P)
=BN(P)+1:GOSUB 700:DIS=10:T=30:GOSUB 630
403 FOR I=1 TO 30:GOSUB 880:FOR J=1 TO 30:NEXT J:GOSUB 860:NEXT I
404 IF P=NP THEN 280
410 GOTO 284
419 REM ** LOSE A BAT **
420 DIS=10:T=9:GOSUB 630
430 YPOS=YPOS+1:P$(YPOS)=BATDN$:POKE 53278,0:SOUND 1,YPOS,10,10:IF PEE
K(53252)=0 THEN 430
445 GOSUB 640:P$=PM$:SCORE(P)=0:BN(P)=BN(P)-1:GOSUB 700:IF BN(P)=0 THE
N POKE 656,0:POKE 657,0:? " ":GOSUB 660
460 GOSUB 850:FOR I=1 TO NP:IF BN(I)>0 THEN 403
470 NEXT I:GOSUB 1000:GRAPHICS 17:POSITION 5,2:? #6;"GameE OveR":FOR I=
1 TO NP:POSITION 3,2+2*I:? #6;"Player #";I;
471 REM Ga, eR AND P IN INVERSE
472 ? #6;" = ";TOTAL(I):NEXT I:POSITION 3,23:? #6;"PRESS ANY KEY";
475 FOR I=1 TO 300:NEXT I:GOSUB 655:IF FL=0 THEN 475
476 GOTO 275
479 REM ** DRAW CAVERN **
480 GOSUB 1000:GRAPHICS 2:GOSUB 2000:POKE 77,0
490 DL=INT(RND(0)*(B-W))+1:YST=B*(DL+1)
500 FOR X=0 TO 19:GOSUB 590:Y=0:FOR I=R+7-DL TO R+6:POSITION X,Y:? #6;
C$(I,I):Y=Y+1:NEXT I
510 FOR I=1 TO W:POSITION X,Y:? #6;" ":Y=Y+1:NEXT I
```

(listing continued on page 97)

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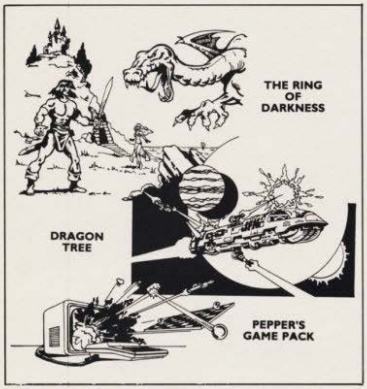

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(listing continued from page 95)

```
520 IF DL.#>=10 THEN Y=Y-1:POSITION X,Y:? #6;"":GOTO 540
530 GOSUB 590:FOR I=R TO R+9-DL-W:POSITION X,Y:? #6;U$(I,I):Y=Y+1:NEXT I
540 IF DL<=1 THEN DL=2:GOTO 570
550 IF DL>=10-W THEN DL=9-W:GOTO 570
560 DL=DL+INT(RND(0)*3)-1
570 NEXT X
580 RETURN
590 R=INT(RND(0)*6)*7+1:RETURN
629 REM ** SOUND SUBR'S **
630 FOR I=15 TO 0 STEP -1:SOUND 0,I,DIS,I:FOR J=1 TO 7:NEXT J:NEXT I:R
ETURN
640 FOR I=10 TO 2 STEP -2:SOUND 0,RND(0)*255,8,I:SOUND 1,RND(0)*255,8,
I:FOR J=1 TO 30:NEXT J:NEXT I
650 SOUND 0,0,0,0:SOUND 1,0,0,0:RETURN
655 RESTORE 697:LS=30:LL=5:GOSUB 664:RETURN
660 RESTORE 690:LS=20:LL=10
664 FL=0
665 READ I,J:IF I=3 THEN RETURN
666 IF I=0 THEN 670
667 IF PEEK(53775)<255 THEN FL=1:RETURN
669 SOUND 0,I,10,10:SOUND 1,I-2,10,6
670 FOR I=1 TO J:FOR K=1 TO LS:NEXT K:NEXT I:SOUND 0,0,0,0:SOUND 1,0,0
,0
675 FOR I=1 TO LL:NEXT I:GOTO 665
680 RESTORE 692:LS=12:LL=12:GOSUB 664
681 IF FL=1 THEN RETURN
682 RESTORE 694:GOSUB 664
683 IF FL=1 THEN RETURN
684 RESTORE 692:GOSUB 664
685 IF FL=1 THEN RETURN
686 RESTORE 696:GOSUB 664
687 IF FL=1 THEN RETURN
688 FOR I=1 TO 300:NEXT I:GOTO 680
690 DATA 243,4,243,4,243,1,243,4,204,4,217,1,217,4,243,1,243,4,255,1,2
43,6,3,3
692 DATA 243,1,217,1,204,1,182,1,162,1,204,1,162,1,0,1,173,1,217,1,173
,1,0,1,182,1,230,1,182,1,0,1
693 DATA 243,1,217,1,204,1,182,1,162,1,204,1,162,1,121,1,3,3
694 DATA 136,1,162,1,204,1,162,1,136,4,3,3
696 DATA 162,1,204,1,162,1,121,1,243,4,3,3
697 DATA 81,4,85,2,102,1,108,1,121,6,108,1,102,1,81,2,81,2,85,2,102,1,
108,1,121,8
698 DATA 108,2,91,2,102,2,108,2,121,1,128,1,121,1,108,1,102,2,121,2,81
,4,102,4,121,8,3,3
699 REM ** SUBR. TO INDICATE BATS LEFT **
700 POKE 656,0:POKE 657,6:? "       ":POKE 657,6:FOR I=1 TO BN(P):? "+
 ":NEXT I:RETURN
850 POKE 656,1:POKE 657,5:? SCORE(P);"    ":RETURN
860 POKE 656,1:POKE 657,12:? TOTAL(P);"    ":RETURN
870 POKE 656,1:POKE 657,5:? "    ":RETURN
880 POKE 656,1:POKE 657,12:? "    ":RETURN
900 GOSUB 630:POKE 53278,0:SCORE(P)=SCORE(P)+25:GOTO 850
999 REM ** SUBR. TO REMOVE PM GR. **
1000 POKE 53277,0:POKE 54272,0:FOR I=53261 TO 53264:POKE I,0:NEXT I:RE
TURN
1999 REM ** SUBR. TO INSERT PM GR. **
2000 POKE 53277,3:POKE 559,46:START=(PEEK(106)+1):POKE 756,START
2009 REM ** ALTER DISPLAY LIST **
2010 A=PEEK(560)+256*PEEK(561)
2020 IF PEEK(A)<>66 THEN A=A+1:GOTO 2020
2030 POKE A,70:POKE A+3,6:POKE A+4,6:POKE A+5,6
2040 RETURN
3000 ? :? :? CHR$(125):? "+ + + + + + BATS + + + + + + + +":?
3010 ? "   The object is to fly your bat":? "through a cavern eating f
lying"
3020 ? "insects along the way. The only":? "control you have is the F
IRE":? "button. Push it to go up."
3030 ? "Release it and your bat starts":? "to fall.":? :? "   A round
lasts 300 points or"
3035 ? "until you lose a bat.  Each time":? "you hit a stilactite or a
"
3040 ? "stilagmite you lose one bat":? "and points earned for that rou
nd."
3050 ? "Each insect you eat scores points":? "but do not eat the brigh
t insect the"
3060 ? "color of your bat.. it is poison!":? "Eat him and you lose rou
nd points":? "plus 100 more and a bat!!":?
3065 ? "PRESS ANY KEY":GOSUB 680:? CHR$(125):? :?
3070 ? "   After a time the cavern will":? "become narrower and scores
 for the"
3080 ? "last round will be added to totals.":? "Every 1000 points you
are given"
3090 ? "another bat, 4 maximum.  Lose":? "all your bats and you are ou
t."
4000 ? "The game is over when everyone is":? "out of bats.  Everyone u
ses the":? "leftmost joystick":? :RETURN
31999 REM ** CHANGE CHARACTER SET **
32000 POKE 106,PEEK(106)-5:GRAPHICS 0:START=(PEEK(106)+1)*256:POKE 756
,START/256:POKE 752,1
32010 ? "INITIALIZING ......"
32020 A=USR(ADR(ZZ$),57344,START):RESTORE 32100
32030 READ X:IF X=-1 THEN RESTORE :RETURN
32040 FOR Y=0 TO 7:READ Z:POKE X+Y+START,Z:NEXT Y:GOTO 32030
32100 DATA 32,255,255,127,127,126,62,62,60
32101 DATA 40,60,28,28,24,8,8,8,8
32102 DATA 48,255,127,126,60,56,24,8,8
32103 DATA 56,8,24,28,124,124,254,254,255
32104 DATA 64,60,126,126,126,126,126,127,255
32105 DATA 72,16,16,16,16,16,24,60,60
32106 DATA 80,255,255,255,255,255,255,255,255
32107 DATA 88,0,24,24,165,165,66,66,0
32108 DATA -1
```


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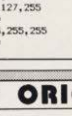
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```
10 PCLEAR2
20 CLEAR1000:PMODE1,1:PCLS1
30 DIMSC(300),DC(30),XC(30),BC(30),CC(30),ST(3),IN(20
,3),DI(20,3),RP(3),PA(20,3),PB(20,3)
40 GOTO1910
50 DRAW"BU1U2E1R2F1D2G1L2U1E2":RETURN:'O
60 DRAW"BR2A4":RETURN:'1 (STRAIGHT)
70 DRAW"R4L4E2R1E1H1L2D1":RETURN:'2
80 DRAW"BU1F1R2E1H1E1H1L2D1":RETURN:'3
90 DRAW"BU4G3R4":RETURN:'4
100 DRAW"R3E1H1L2H1U1R4":RETURN:'5
110 DRAW"BE3G1D2F1R2E1H1L2D1":RETURN:'6
120 DRAW"E4L4":RETURN:'7
130 DRAW"BR2E1H1L2H1E1R2F1G1L2G1F1":RETURN:'8
140 DRAW"R3E1U2H1L2G1F1R2E1":RETURN:'9
150 DRAW"U2E2F2D2U2L3":RETURN:'A
160 DRAW"U4R2F1G1L3R2E1H1L3":RETURN:'B
170 DRAW"BU1U2E1R2F1BD2G1L2":RETURN:'C
180 DRAW"U4R3F1D2G1L3":RETURN:'D
190 DRAW"R4BL4D4U2R3":RETURN:'E
200 DRAW"U4R4BD2BL3L3":RETURN:'F
210 DRAW"BE4L3G1D2F1R2E1U1L1":RETURN:'G
220 DRAW"U4D2R4U2D4":RETURN:'H
230 DRAW"BU4R4L2D3G1H1":RETURN:'J
240 DRAW"U4D2R2E2BD4H2":RETURN:'K
250 DRAW"R4L4U4":RETURN:'L
260 DRAW"U4F2E2D4":RETURN:'M
270 DRAW"U4F4D4":RETURN:'N
280 DRAW"U4R3F1G1L2":RETURN:'P
290 DRAW"BU1U2E1R2F1D1G2L1BU2BR1F2":RETURN:'Q
300 DRAW"U4R3F1G1L2H1F2":RETURN:'R
310 DRAW"R3E1H1L2H1E1R2":RETURN:'S
320 DRAW"BU4R4L2D4":RETURN:'T
330 DRAW"BU4D3F1R2E1U3":RETURN:'U
340 DRAW"BU4D2F2E2U2":RETURN:'V
350 DRAW"BU4D3F1E1U1D1F1E1U3":RETURN:'W
360 DRAW"E4BL4F4":RETURN:'X
370 DRAW"BR2U2E2BL4F2":RETURN:'Y
380 DRAW"BR4L4E4L4":RETURN:'Z
390 DRAW"U4R1D4R1U4R1D4R1U4":RETURN:'BLANK
400 A$=INKEY$:IFA$=""THEN400:RETURN
410 DRAW"BM"+STR(XB)+","+STR(YB):RETURN
420 FORI=A TOB:SC(I)=100:NEXT:RETURN
430 YB=INT(I/20):IFYB>3:I/20THENYB=YB+1
440 XB=I-20*(YB-1):RETURN
450 CLS:PRINT"SELECT COUNTRY YOU WISH TO",,"EXPLORE, PL
EASE":PR=101:PW=229:PH=32
460 PRINTPW,"(1)  S. ENGLAND/WALES"
470 PRINTPW+12,"(2)  N. ENGLAND/WALES"
480 PRINTPW+1,"(3)  SCOTLAND"
490 PRINTPW+15,"(4)  IRELAND-NORTH"
500 PRINTPW+25,"(5)  IRELAND-SOUTH"
510 PRINTPW+32,"POSITION CURSOR USING"
520 PRINTPW+55,"UP & DOWN ARROWS"
530 PRINTPW+87,"THEN PRESS 'ENTER'"
540 PR=PR+1:PW=PW+1:PH=PH+(32)
550 P9=101:P9=1
560 PRINTPW,CH$;
570 P9=INKEY$:IFP9#""THEN570
580 IFP9=CH$(10)AND P9<N9 THENPRINTPW,D9$;:P9=P9+P9
(P9<P9+1):GOTO560
590 IFP9=CH$(94)AND P9>M9 THENPRINTPW,D9$;:P9=P9-P9
(P9>P9-1):GOTO560
600 IFP9#CH$(13)THENRETURN
610 GOTO570
620 AZ=1:GOSUB400
630 IFA#=CH$(8)THENSCREEN1,0:AZ=0:GOTO620
640 IFA#=CH$(13)THENP=0:RETURN
650 IFA#=CH$(95)THENXI=2:GOTO630
660 B=INSTR(1,UL$,A#):RETURN
670 IFB=0THEN20ELSEA#=A#
680 PRINTA#;
690 GOSUB400
700 IFA#=CH$(8)THENSCREEN1,0:AZ=0:GOTO690
710 IFA#="1"ORA#>"9"THEN690ELSEA#=A#+A#
720 PRINTA#;
730 C1=VAL(A#)
740 GOSUB400
750 IFA#=CH$(13)THEN790
760 IFA#="0"ORA#>"5"THEN740ELSEA#=A#+A#
770 PRINTA#;
780 C1=C1*10+VAL(A#):GOTO740
790 IFC1<1ORC1>15THEN800ELSEP=B+(C1-1)*20:PRINT:RETUR
N
800 PRINT:PRINT"INVALID CODE - PLEASE REDO":GOTO620
810 DRAW"BR2BM0,1H2R2D2R3D2R2L1G2L3D2L3D2R4H4G1R2
E1R7E4D3H4L4F2R3E2F2A8E2R1E3R4E4U2D5D7D1G3D8F1L16H1L5D
2F1D2R3L3H1L2D4G1D4R2"
820 DRAW"L3D2D1D2D2H2L1D4F2R3D2R3U4R2E4R2F2R8F2R3E4U3L
2U2E3U4F2E2R5F4U3R6F1E2U1H2R2F2R5E3U3H1F4R2F4E3E2"
830 DRAW"R4E1BF1D2F2E5R4F1E1U3E7U2E1L1D2E1H1L4D2H4L4
R5E2R3E5U5L4R2E2R3E4L4U5F2E4U7E1U1G1U1U3"
840 DRAW"BM150,152R1E3R3F3G3L2H3"
850 A=1:B=4:GOSUB420
860 A=21:B=24:GOSUB420
870 A=41:B=45:GOSUB420
880 A=120:B=125:GOSUB420
890 A=140:B=144:GOSUB420
900 A=159:B=163:GOSUB420
910 A=238:B=240:GOSUB420
920 A=247:B=251:GOSUB420
930 A=254:B=260:GOSUB420
940 A=267:B=280:GOSUB420
950 A=283:B=300:GOSUB420
960 A=220:B=222:GOSUB420
970 A=181:B=182:GOSUB420
980 A=201:B=202:GOSUB420
990 A=61:B=62:GOSUB420
1000 SC(25A)=100
1010 RETURN
1020 DRAW"C2S8BM5A,14D3G1D1G1D1G1D1G1D4H1U2L2D4F2D4E1U
```

No exploration of the outer reaches of the galaxy in this game. It is set a little closer to home — the British Isles. The object is simply to get rich and stay rich. A. P. Chybalski explains.

DRAGON XPLORER

THIS GAME IS BASED on the geography, industry and agriculture of the British Isles. The players decide on which of the five areas they wish to explore:

- Southern England and Wales.
- Northern England and Wales.
- Scotland.
- Ireland — North.
- Ireland — South.

A map of the area chosen is then displayed, divided into squares by a grid. The object of the game is to explore the area on the map by moving from square to square. Exploration costs £50 per square, the players all starting with £100.

Resources are to be found in some squares; the player finding these, receives a royalty payment. If these squares are subsequently developed, a fixed income per turn is obtained from them.

Development cannot be started until a player has more than £2,000 of ready cash. Individual squares can be developed or a rolling program can be set up which gives a cost saving of about 10 percent. A rolling program is set up by a player when he wishes to develop more than one square in succession.

The program is maintained by the computer. When the development of one square finishes, the next is started. Income is received from any square that has been fully developed. Players can have a maximum of two rolling programs.

Money can be lent to the bank at a rate of 10 percent interest and borrowed at 20 percent. A player must not run out of ready cash or obtain a bank deficit of greater than £10,000. If this occurs, the player ceases to take active part in the game as he is declared bankrupt.

Players can explore a given number of squares per turn depending on how much ready cash they have. This is summarised in Table 1.

Table 1.

0- 200	1 square
200- 1000	2 squares
1000- 2000	3 squares
2000- 5000	5 squares
5000-10000	7 squares
10000 plus	8 squares

A player can move from any of his own squares to explore others or can take a helicopter ride to a totally isolated square. Such a helicopter ride is equivalent to four squares worth of exploration. Development also uses one squares worth of exploration.

Players move around the map by pressing the arrowed keys. They may only move to a square that has not already been visited. Pressing Enter allows the player to define a new starting point for any exploration that remains to him.

The game ends when either all the players are bankrupt or all the available squares have been explored. The game can be ended earlier by pressing Shift ↑ in reply to being asked for a square code number at the start of exploration. When Enter is pressed at the start of exploration with no square code, no more exploration is carried out for the current turn for the current player.

Pressing Enter with no square code during development aborts the development and asks whether the player wishes to continue.

Symbols on the maps.

Player 1 — Yellow squares.
Player 2 — Red squares.
Player 3 — Blue squares.

Lettering in the squares on the map indicates discoveries. Green lettering indicates undeveloped discoveries, contrasting lettering on a player's coloured squares indicates that the square has been developed.

If a player wishes to refer to the map while he is entering a square code number, he has only to press ←. Typing in a code number returns to the text screen.

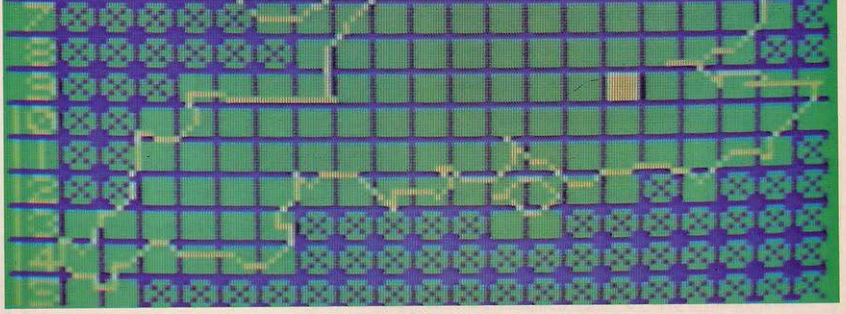
This program is about 25K in length before Running. It takes about 1½ hours to play. Taped copies of this program and programs based on France, Germany, Austria, Australia or the USA can be obtained from: A. P. Chybalski, 91 Heath Avenue, Rode Heath, Stoke-on-Trent, ST7 3TH enclosing a cheque or postal order for £4.

Code letters of commodities

A	Orchards.
B	Cattle farming.
C	Coal
D	Dockyards.
E	Engineering.
F	Fisheries.
G	Suger beet.
H	Chemicals.
J	Iron ore.
K	Forestry.
L	Sheep farming.
M	Car manufacture.
N	Tin mining smelting.
P	Potatoes.
Q	Oats
R	Oil refinery.
S	Steel.
T	Textiles.
W	Wheat.
X	Whiskey.
Y	Clothing manufacture.
Z	Potteries.

```
4R4F4R3U5R1F3R4E1R4E1R2U3R1G2L3G4D3D3G4F4D7E5F1D3E3R3
D3D3D3
1030 DRAW"L4B1D7R4B2L1B2DAF3R6B3L3H4G1L2D1F2D3H5G2L8H2
G3L1D3D2D3D3R4E4R5D3D1D5"
1040 DRAW"BM150,140;R2D5F1D4F2D5R3F3R2F1D4R4D2D3F2D4F
2D5F2D4L2E1L3H4L5R4F4R3F4D5D6F4R2U6E3R8F2R1"
1050 DRAW"BM8,164;E1U1E4U1E1L1L2L5D5L1R2F5"
1060 DRAW"BM34,94;R3E3U5E1U3H2D3D2D2R4D2D3"
1070 A=13:B=20:GOSUB420
1080 A=33:B=40:GOSUB420
1090 A=50:B=20:GOSUB420
1100 A=74:B=82:GOSUB420
1110 A=84:B=85:GOSUB420
1120 A=95:B=101:GOSUB420
1130 A=104:B=105:GOSUB420
1140 A=116:B=121:GOSUB420
1150 A=126:B=125:GOSUB420
1160 A=137:B=146:GOSUB420
1170 A=157:B=166:GOSUB420
1180 A=177:B=186:GOSUB420
1190 A=190:B=206:GOSUB420
1200 A=218:B=220:GOSUB420
1210 A=239:B=240:GOSUB420
1220 A=259:B=261:GOSUB420
1230 A=281:B=283:GOSUB420
1240 A=311:B=305:C(42)=100
1250 RETURN
1260 DRAW"C5BBM108,190E3U1H3E5U3R7L2H3L3D1D3H4U5E1U
2E3U2E1D4D2D3D6L5U3E1U8E3U1E7L2G3L1G4L2H4R5U1H
1R1H2E1R4H2E1U1E5H1H2R4H4U3H2G2
1270 DRAW"R5H2U5R1F3U2H2U4R3H1U3E1R4H1U2E3U2E1R8D2D3E5
F2D1U1E5E3R3F2D4F1R4L2G2L5G4L1F2G5R4G1E1F1R6D2R4E4
R3E3"
1280 DRAW"F2R1F1E1F2F4D4G6D2G3D7L2G3L8R1F1E5D4R4G4L7R
3L1G2R1E7E3R4F1BR6L2D4D3R4G4L2G4L3H2U5E2U4R7E4"
1290 DRAW"BM44,54G5L1U3H1E2R3F1BR2R,7D2G3H2U2R5BD2,8
3L2BR5H1D3R5U7R1L1H2BR5,1L4F3D3H5E3R5U,1L4G3U4L2H
2E2R2G3"
1300 DRAW"BM32,160F2D1L4U2E1R4BR4R,13F7D3G2L1U1R4E1L
2U1R1E2H5E3BR4R,7D7D2F2R4G3D1G3U4E1L4H3U2H3H5L3U3R2F2
U3F4U3E2"
1310 A=19:B=31:GOSUB420
1320 A=8:B=7:GOSUB420
1330 A=16:B=22:GOSUB420
1340 A=36:B=41:GOSUB420
1350 A=55:B=61:GOSUB420
1360 A=64:B=66:GOSUB420
1370 A=74:B=80:GOSUB420
1380 A=95:B=97:GOSUB420
1390 A=83:B=84:GOSUB420
1400 A=99:B=100:GOSUB420
1410 A=159:B=160:GOSUB420
1420 A=179:B=182:GOSUB420
1430 A=198:B=203:GOSUB420
1440 A=217:B=215:GOSUB420
1450 A=237:B=240:GOSUB420
1460 A=256:B=245:GOSUB420
1470 A=275:B=265:GOSUB420
1480 A=142:B=143:GOSUB420
1490 A=279:B=285:GOSUB420
1500 SC(26)=100:SC(46)=100:SC(120)=100:SC(162)=100:SC(
200)=100:SC(140)=100:SC(165)=100
1510 RETURN
1520 DRAW"C5BBM54,190U1L2E1L4A4E1U1R5U3E4R5U6L9H2G2U3
L3H2U1R2E1R3F2E1U1H1U2E3H2E5U4E3F1R2U2R1F2D2E2U2R9F1D
1F3U4D2R5E4L2F1R3E4U1E4L4H2L2E1U1"
1530 DRAW"L2H1L3H3U2R2E1R4H2R5U2H2U1E2U3E1R4U5E1R4E1R1
D1F1D1E2R5D3F1E4L4U2F1R1U1H5H2F4D1L2R4R4F2U1R5E3R3F1
R4E1"
1540 DRAW"R2D7R2D5F3D4E1U3E1F1D3G4L4G4R3E2R4F1D3F1D1H
3U3H3D1R3F1D3G2L4G3G2D3L1H3G1F4G2L4H2D7R2D1F4BM108
,40D2L2H2E1R2"
1550 A=13:B=12:GOSUB420
1560 A=15:B=30:GOSUB420
1570 A=39:B=47:GOSUB420
1580 A=59:B=67:GOSUB420
1590 A=79:B=86:GOSUB420
1600 A=101:B=106:GOSUB420
1610 A=121:B=128:GOSUB420
1620 A=141:B=147:GOSUB420
1630 A=219:B=220:GOSUB420
1640 A=238:B=242:GOSUB420
1650 A=257:B=261:GOSUB420
1660 A=277:B=281:GOSUB420
1670 A=298:B=300:GOSUB420
1680 SC(181)=100:SC(200)=100:SC(163)=100
1690 RETURN
1700 DRAW"S6C2BM232,14F1D2L1H2L2D2F2D2F1D1R2F1G1D3E1D
2E1D3E1D2E4H1D2E1D3G2L5F3E3H4L2E1L5H1L1E3U4H2D2F1D3
E1L1D6L1G2L1D2F1L2E2L4U2E1H1L4H1D3F1U1H4L4
1710 DRAW"G1L3E1L1E1L7E3L3E1L4E1L4E2E3L1E1L1E1L5E2E1E1
R2E2L4E1L2E1L9E2E1E5E2E2E3L3E1L3G1L1G2L3H1U3L5U3E1R2
E2R2E1E5E4L3E1L1L1"
1720 DRAW"H4U1E2R5U3E1F1D2F1R4E2L3U4H3U1R4E3H1E4U2R4F1
R6E2R1G1R5H4U5E2H1G3D3G2L2G2H1U1L4R2E1L1U6E3R2E4U5E3U1L
3U2E3R2E2F1R8E2R2E1L1H1"
1730 DRAW"BM128,170D1H1"
1740 A=18:B=2:GOSUB420
1750 A=20:B=23:GOSUB420
1760 A=37:B=43:GOSUB420
1770 A=59:B=62:GOSUB420
1780 A=80:B=82:GOSUB420
1790 A=100:B=101:GOSUB420
1800 A=119:B=123:GOSUB420
1810 A=139:B=142:GOSUB420
1820 A=159:B=161:GOSUB420
1830 A=179:B=181:GOSUB420
1840 A=199:B=200:GOSUB420
1850 A=218:B=220:GOSUB420
1860 A=238:B=240:GOSUB420
1870 A=253:B=260:GOSUB420
1880 A=272:B=281:GOSUB420
1890 A=291:B=300:GOSUB420
1900 RETURN
1910 CLS:PRINT"GEOGRAPHICAL EXPLORATION GAME-:" FOR
2 OR 3 PLAYERS...,...,"THE OBJECT OF THIS GAME IS TO","
EXPLORE THE COUNTRY SHOWN ON THEMAP BY MOVING FROM SQU
ARE TO","SQUARE. THE EXPLORATION COST PERSQUARE IS 50
POUNDS. RESOURCES"
1920 PRINT"ARE TO BE FOUND IN SOME SQUARES, FOR FINDIN
G WHICH YOU GET A","SINGLE ROYALTY PAYMENT. IT THE SQ
UARES ARE LATER DEVELOPED; A FIXED INCOME PER TURN IS
","OBTAINED FROM THEM."
1930 PRINT:PRINT"HOW MANY PLAYERS (2-3)";
1940 GOSUB490
1950 IFA#="2"THENNP=2:GOTO1970
1960 IFA#="3"THENNP=3:GOTO1970
1970 GOSUB450
1980 SC(0)=-100:BN=BV:CLS:PRINT"YOU CANNOT START DEVEL
OPING","UNTIL YOU HAVE MORE THAN 2000 POUNDS READY C
ASH.","- YOU CAN DEVELOPE INDIVIDUAL SQUARES OR YO
U CAN SET UP A","ROLLING DEVELOPEMENT PROGRAM","WHICH
GIVES A COST SAVING OF"
1990 PRINT"10%. YOU CAN HAVE A MAXIMUM OF TWO ROLLING
PROGRAMS.",,,,,"YOU ARE ALSO ABLE TO BORROW MONEY
FROM THE BANK AT 20% AND CAN LOAN MONEY AT 10%. YOU
MUST NOT RUN OUT OF READY CASH!"
2000 GOSUB490
2010 FORY=1TOGN:FORX=1TO30
2020 READCC(X),CC(X),BC(X),CC(X):NEXTX
2030 READSY(Y),ST(Y),ET(Y),NT(Y):NEXTY
2040 CLS:PRINT"YOU CAN EXPLORE A GIVEN NUMBER OF SQUA
RES PER TURN DEPENDING ONHOW MUCH READY CASH YOU HAVE:
","- 1 SQUARE","- 200 - 1000 2
SQUARES","- 1000 - 2000 3 SQUARES","- 2000 - 500
0 5 SQUARES"
2050 PRINT" 5000 - 10000 7 SQUARES"," 10000 PLUS
8 SQUARES"
2060 PRINT:PRINT"YOU CAN MOVE FROM ANY OF YOUR OWN S
QUARES TO EXPLORE OTHERS ONTAKE A HELICOPTER RIDE WHIC
H IS EQUIVALENT TO USING FOUR SQUARESWORTH OF EXPLORAT
ION."
2070 GOSUB6490
2080 COLOR3,2
2090 FORX=16TO246STEP12
2100 LINE(X,0)-(X,190),PSET:NEXT
2110 FORX=12TO180STEP12
2120 LINE(0,X)-(254,X),PSET:NEXT
2130 FORX=1TO20
2140 DRAW"BM"+STR#(X*12+6)+",10C2B8"
2150 ONX GOSUB150,160,170,180,190,200,210,220,230,240,
250,260,270,280,300,310,320,330,350,360
2160 NEXT
2170 FORX=1TO15
2180 DRAW"BM4,"+STR#(X*12+10)+"C2B8"
2190 ONX GOSUB60,70,80,90,100,110,120,130,140,50,60,70
,80,90,100
2200 NEXT
2210 FORX=0TO5
2220 LINE(2,X*12+13)-(2,X*12+22),PRESET
2230 NEXT
2240 CLS:PRINT" DEVELOPEMENT ADDITIONALLY USEGA SOMAE
ES WORTH OF EXPLORATION. YOU MAY NOT EXPLORE THE SEA O
R ANY ADJACENT COUNTRIES. ALSO YOUMAY NOT ENTER TERRI
TORY THAT HASALREADY BEEN EXPLORED, EITHER BYYOURSELF
OR ANY OPONENT."
2250 PRINT:PRINT" THE GAME ENDS WHEN EITHER ALL THE A
VAILABLE SQUARES HAVE BEEN EXPLORED OR WHEN ALL THE PL
AYERSHAVE HAD ACTIVITIES SUSPENDED DUE TO A SHORTAGE
OF READY CASH."
2260 GOSUB6490
2270 NL=".ABCDEFGHIJKLMNOPRSTUWX"
2280 C$=".ABCDEFGHIJKLMNOPORSTUWXYZ"
2290 ONX GOSUB1010,1020,1260,1520,1700
2300 CLS:PRINT"SYMBOLS ON THE MAP:","- PLAYER 1 YE
LLOW SQUARES","- PLAYER 2 - RED SQUARES","- PLAYER
3 - BLUE SQUARES"
2310 PRINT:PRINT"THE LETTERING ON THESE SQUARES INDIC
ATE DISCOVERIES:","-GREEN ON PLAYER COLOUR - SQUARE H
AS NOT BEEN DEVELOPED.","-CONTRAST ON PLAYER COLOUR T
HE," SQUARE HAS BEEN DEVELOPED."
2320 PRINT:PRINT"IF YOU WISH TO CHANGE TO THE MAPWHEN
ENTERING A SQUARE'S CODE NUMBER, PRESS -:"
2330 DRAW"C5"
2340 FORI=1TO300:IFSC(I-)>100THENZ$#0
2350 GOSUB452
2360 X8=X8+12:A1YB=YB+12:K10
2370 GOSUB410
2380 GOSUB450
2390 NEXT
2400 PRODE1,1:L=ST(1)
2410 SC(1)=L:GOSUB430
2420 X8=X8+12:A1YB=YB+12:K10
2430 DRAW"C2":GOSUB410
2440 GOSUB390
2450 I=ST(2):SC(I)=2:GOSUB430
2460 X8=X8+12:A1YB=YB+12:K10
2470 DRAW"C4":GOSUB410
2480 GOSUB390
2490 TFNP=2THEN2550
2500 I=ST(3):SC(I)=3:GOSUB430
2510 X8=X8+12:A1YB=YB+12:K10
2520 DRAW"C3":GOSUB410
2530 GOSUB390
2540 RC(3)=100:NG=NG+1
2550 NG=NG+3:RC(1)=100:RC(2)=100:PL=1:GOTO3910
2560 DATABCATTLE FARMING,5,2,350
2570 DATAGUGAR BEET,15,1,175
2580 DATAWHEAT,19,1,300
2590 DATA.BEEF FARMING,27,2,250
2600 DATABCATTLE FARMING,30,2,375
2610 DATAWHEAT,37,1,300
2620 DATAGUGAR BEET,79,1,200
2630 DATAORCHARDS,72,1,150
2640 DATABCATTLE FARMING,83,2,375
```

(listing continued on page 103)



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(listing continued from page 101)

```
2650 DATALCHEF FARMING,86,2,250
2660 DATARTIN SMELTING,104,2,400
2670 DATACCOAL,106,3,500
2680 DATACOAL,127,3,550
2690 DATAYCLOTHING M'FACTURE,94,1,200
2700 DATAWHEAT,97,1,400
2710 DATAENGINEERING,137,1,450
2720 DATAWOOD M'FACTURE,155,2,350
2730 DATAMCAR M'FACTURE,153,2,400
2740 DATAENGINEERING,148,1,500
2750 DATAENGINEERING,174,1,400
2760 DATAMOTOR REFINING,178,3,700
2770 DATACCOAL,199,3,500
2780 DATAFORESTRY,196,3,250
2790 DATAWHEAT,234,1,525
2800 DATAROIL REFINING,232,3,600
2810 DATABCATTLE FARMING,204,2,350
2820 DATAFISHERIES,246,1,150
2830 DATAGOLDSMITHS,185,2,300
2840 DATADOCKYARDS,264,4,700
2850 DATARTIN MINING,262,3,400
2860 DATA175,33,180,213
2870 DATABCATTLE FARMING,24,2,400
2880 DATACCOAL,6,3,500
2890 DATAPIGGERY FARMING,29,2,350
2900 DATALSHEEP FARMING,67,2,250
2910 DATAENGINEERING,123,1,700
2920 DATAENGINEERING,93,3,450
2930 DATAGRAIN FARMING,94,4,600
2940 DATACCOAL,112,3,500
2950 DATACCOAL,114,2,500
2960 DATALSHEEP FARMING,135,2,200
2970 DATAWOOD M'FACTURE,153,3,150
2980 DATAPIGGERY FARMING,172,2,300
2990 DATATTEXTILES,169,2,250
3000 DATAFISHERIES,167,1,150
3010 DATAENGINEERING,195,3,450
3020 DATAFORESTRY,214,3,350
3030 DATACCOAL,189,3,450
3040 DATAWOOD,229,3,700
3050 DATAENGINEERING,219,3,450
3060 DATAWOOD M'FACTURE,193,1,250
3070 DATACCOAL,213,3,500
3080 DATAENGINEERING,4,7,700
3090 DATARSTEEL,233,4,730
3100 DATACCOAL,253,3,540
3110 DATAWHEAT,271,1,500
3120 DATAWHEAT,295,3,440
3130 DATAZPOTTERIES,271,2,500
3140 DATACCOAL,291,3,500
3150 DATARSTEEL,247,4,550
3160 DATALSHEEP FARMING,244,2,300
3170 DATAROY,211,1113,119
3180 DATALSHEEP FARMING,23,2,150
3190 DATALSHEEP FARMING,121,2,150
3200 DATALSHEEP FARMING,124,2,150
3210 DATALSHEEP FARMING,68,2,200
3220 DATAGOATS,34,2,375
3230 DATAGOATS,118,2,350
3240 DATAFISHERIES,126,1,400
3250 DATAFISHERIES,186,1,175
3260 DATAWHISKEY,167,4,400
3270 DATAFISHERIES,228,1,325
3280 DATAHCHEMICALS,248,3,650
3290 DATALSHEEP FARMING,267,2,200
3300 DATAWHISKEY,191,4,375
3310 DATAWHISKEY,173,4,350
3320 DATAGOATS,114,2,400
3330 DATAFORESTRY,116,3,300
3340 DATAFORESTRY,157,3,350
3350 DATAFFISHERIES,118,1,300
3360 DATAGOATS,177,2,350
3370 DATAGOATS,216,2,325
3380 DATACCOAL,217,3,525
3390 DATADSHIPBUILDING,250,4,700
3400 DATAGOATS,271,2,350
3410 DATATTEXTILES,274,2,200
3420 DATACCOAL,277,3,525
3430 DATABCATTLE FARMING,294,2,250
3440 DATACCOAL,297,3,500
3450 DATA171,230,194,210
3460 DATAZPOTTERIES,71,2,350
3470 DATALFISHERIES,75,1,300
3480 DATAENGINEERING,93,3,400
3490 DATAWHEAT,95,1,325
3500 DATAWHEAT,78,1,300
3510 DATAENGINEERING,119,4,400
3520 DATAYCLOTHING M'FACTURE,130,1,250
3530 DATAWHEAT,153,1,300
3540 DATATTEXTILES,135,2,220
3550 DATATTEXTILES,156,2,210
3560 DATAENGINEERING,139,3,450
3570 DATAWHEAT,176,2,300
3580 DATAWHEAT,195,1,325
3590 DATALSHEEP FARMING,191,2,300
3600 DATABCATTLE FARMING,187,2,325
3610 DATABCATTLE FARMING,228,2,210
3620 DATABCATTLE FARMING,233,2,200
3630 DATAGOSUMM BEET,267,1,300
3640 DATABCATTLE FARMING,291,2,350
3650 DATABCATTLE FARMING,295,2,230
3660 DATAPOTATOES,254,1,200
3670 DATA,,,
```

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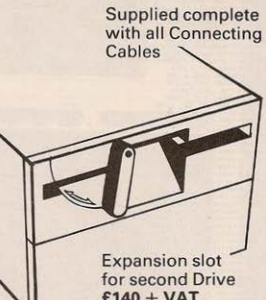

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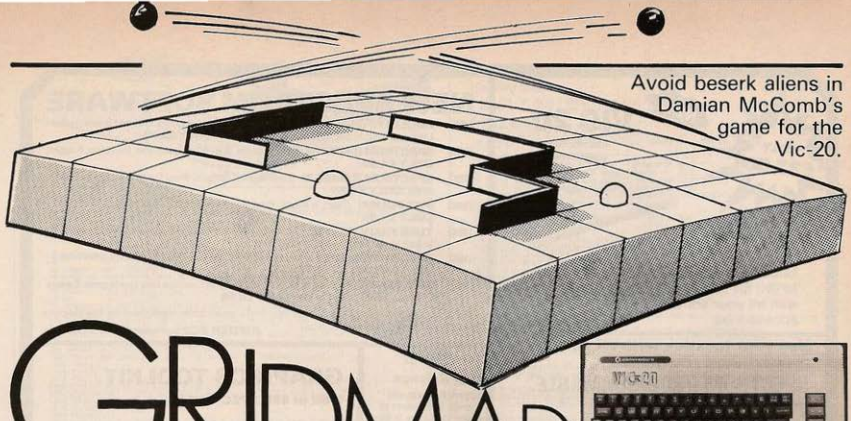

GRIDMAD

GRIDMANIA IS AN Amidar-type game in which you control your grid-glider on a white grid with numerous berserk aliens in pursuit. Your grid-glider leaves a black trail and you have to completely blacken the grid and then return to home base — the pulsating character in the centre of the grid.

But before the game I will describe how to type it in and Save it. The game will run on an unexpanded Vic-20 but requires at least a 3K expansion to type in. The extra memory is needed to store the loader program. This program will help you to enter and manipulate the object code in hex.

Before running the loader you must store it either above or below unexpanded Vic memory.

For Vics with 3K expansion type:

```
POKE 641,0: POKE 642,4: POKE 643,0:
POKE 644,16: SYS 64824
```

Then type in and Save the loader.

If you have a 16K expansion inserted type:

```
POKE 641,0: POKE 642,32: POKE 643,0:
POKE 644,96: POKE 648,30: SYS 64824
```

But the very first thing to be typed in is program 1. This sets the Vic up to load the game itself.

Press 1 — You enter a start address and then start entering the object code in hex. End by typing 'END'.

Press 2 — You are asked for a start address and then the contents of memory is listed in hex from that address on. To continue the listing press the space bar or to return to menu press any other key.

Press 3 — Loads code into memory from which it was Saved.

Press 4 — Saves code between start and end addresses entered by you.

Once you have entered all the code, to make further copies type:

```
POKE 43,1: POKE 44,16: POKE 45,0: POKE
46,30: SAVE " ", 1,1
```

Obviously each copy of this object code must be preceded by a copy of program one.

To control your grid-glider you can use a joystick or a large selection of keys:

(continued on page 107)

Hex dump.

```
4100  78 A9 11 8D 14 03 A9 10 8D 15
4110  03 58 60 85 9E 29 18 85 9F E6
4120  9E A0 00 8C 3B 10 A0 F8 8C 3E
4130  10 20 36 10 A0 D0 8C 3B 10 A0
4140  08 8C 3E 10 20 36 10 10 90 0F
4150  A0 07 AC 9F BD D0 1D 99 00 1C
4160  E8 88 C0 FF D0 F4 60 20 9F FF
4170  A5 C5 C9 08 D0 25 A0 00 8C 0E
4180  20 9F FF A5 C5 C9 08 F0 F7
4190  20 9F FF A5 C5 C9 08 D0 F7 20
4200  9F FF A5 C5 C9 00 F0 F7 A0 0F
4210  8C 0E 90 A2 7F 8E 22 91 8C 20
4220  91 CC 20 91 D0 F8 A2 FF 8E 22
4230  91 A2 7F 8E 20 91 A0 1F 91 CD
4240  1F 91 D0 F8 4B 29 1C 4A C8 88
4250  90 02 09 10 A8 C8 29 20 C9 20
4260  90 EA 49 8F 29 7F F0 07 A9 BD
4270  F1 10 10 90 3A A9 BD 8D 20 91
4280  AD 21 91 C9 FF F0 04 A9 92 D0
4290  2A A9 E7 8D 20 91 AD 21 91 C9
4300  FF F0 04 A9 12 D0 1A A9 BD 8D
4310  20 91 AD 21 91 C9 FF F0 0C C9
4320  F7 B0 04 A9 01 D0 06 A9 81 D0
4330  02 A9 00 85 06 18 90 0A 92 12
4340  00 81 00 00 00 01 00 00 85 A4
4350  F8 16 C6 A3 D0 12 A9 C8 85 A3
4360  A6 A4 E6 D7 1F BD 27 1F C9 11
4370  D0 02 C6 A4 45 A7 F0 14 A6 A6
4380  BD 38 11 8D 0C 90 C6 A6 D0 08
4390  A9 00 85 A7 A9 A0 85 A8 4C CE
4400  14 00 EE EA E7 E0 E7 EA E7 E0
4410  DA EA E7 E0 42 4C 4C 4C 4C 4C
4420  4C 4C 43 4C 4C 4C 43 4C 4C 4C
4430  44 20 00 4B 20 20 4B 20 20
4440  20 4B 20 20 20 4B 20 20 20 4B
4450  20 00 49 4C 4C 4C 4B 4C 4C 4C
4460  4B 4C 4C 4C 4B 4C 4C 4C 4C 45 20
4470  00 45 4C 4C 4C 47 4C 4C 4C 47
4480  4C 4C 4C 47 4C 4C 4C 46 20 00
4490  A9 3E A0 11 4C 1E CB A9 51 A0
4500  11 4C 1E CB A9 64 A0 11 4C 1E
4510  CB A9 77 A0 11 4C 1E CB A0 12
4520  A2 00 10 20 F0 FF A9 05 20 09
4530  E1 20 BA 11 20 91 11 20 91 11
4540  A9 07 A0 20 98 11 20 91 11 20
4550  91 11 68 AA CA 8A D0 F0 4C 9F
4560  11 A0 03 A2 00 18 20 F0 FF A9
4570  02 8D 8E 02 85 00 AC 01 20 FE
4580  11 A4 0C A2 00 18 20 F0 FF A9
4590  02 8D 8E 02 85 02 A4 03 85 62
4600  86 63 A2 90 38 20 49 DC 20 DF
4610  D0 A2 09 CA D0 00 01 D0 FA A9
4620  30 A0 FF 99 00 00 88 E8 E0 06
4630  90 F7 C8 C8 98 D0 04 A0 01 D0
4640  02 A0 00 4C 1E CB A5 00 C5 02
4650  D0 10 D0 06 A5 01 C5 03 90 08
4660  A5 01 85 03 A5 00 85 02 20 D1
4670  11 85 AC D0 2D A5 00 C9 05 90
4680  27 D0 06 A5 01 C9 DC 90 1F E6
4690  A5 A2 04 86 A6 A9 20 9D F1 1F
4700  A9 06 9D F1 97 CA D0 F3 A6 A5
4710  F0 08 A9 21 9D F1 1F CA D0 FA
4720  60 A9 9C 20 09 E1 A9 00 A6 0C
4730  85 62 86 63 A2 90 38 20 49 DC
4740  20 DF D0 A0 06 A5 0C A2 16 C9
4750  0A B0 01 C8 18 20 F0 FF A9 00
4760  A0 01 4C 1E CB 48 98 48 A9 05
4770  85 A9 A0 00 EA 88 C0 00 D0 FA
4780  C6 A9 D0 F4 CA D0 F0 68 A8 68
4790  60 A2 04 A9 00 9D 00 30 CA D0
4800  FA 60 A9 DC 85 AB 20 B7 12 A2
4810  04 A4 AB EA EA EA EA EA E6 B1
4820  D0 02 E6 00 20 26 12 A9 00 8D
4830  0C 90 68 AA CA D0 E6 85 AB 60
4840  02 90 CE AB 85 A4 F0 11 A6 A4
4850  FE D7 1F BD D7 1F C9 11 D0 02
4860  C6 A4 18 90 C8 4C B7 12 20 94
4870  E9 A5 62 29 03 85 AC C0 A2 00
4880  A9 0E 9D D7 1F 8A CA 9D D7 1F
4890  C0 D0 F8 A9 00 85 A4 A0 08 D3
4900  9D D7 97 CA D0 FA 60 EA 52 53
4910  12 38 00 54 55 12 38 00 58 59
4920  12 38 00 5A 5B 0C 3E 00 5E 5F
4930  20 12 38 00 00 00 00 00 00 00
4940  15 0C 16 02 09 40 85 FF A9 0C
4950  48 A9 90 20 09 E1 A9 92 20 09
4960  E1 68 AA CA 8A 48 0A A0 D0 45
4970  13 D0 D3 44 13 A8 18 20 F0 FF
4980  85 FF A0 13 20 1E CB 85 FF 38
4990  E9 05 85 FF C9 27 D0 D1 68 60
5000  85 03 48 A5 02 48 A9 92 20 09
5010  E1 A9 93 20 09 E1 A9 EA 85 00
5020  A9 85 01 20 26 12 A9 00 85
5030  00 85 01 85 AC 85 A7 85 A8 A9
5040  01 85 0C A9 02 85 85 85 02 85
5050  A4 68 85 02 68 85 03 20 26 12
5060  A2 04 20 57 12 20 71 12 20 8E
5070  13 A9 30 A9 EA 1F C9 04 85 FA
5080  97 60 A5 A9 20 D8 C6 A0 A5 A9
5090  29 04 C9 04 D0 04 A9 1D D0 02
5100  A9 1E A0 00 91 04 E6 AE A5 04
5110  85 FE A5 05 18 69 79 85 FF A5
5120  AE 31 FE 18 90 06 A0 00 A9 20
5130  91 04 4C 15 EB 78 A9 D8 92 14
5140  03 A9 13 85 15 03 A9 70 85 40
5150  58 20 37 12 A0 A0 33 A9 34 29
5160  0F 48 B9 00 95 0A 0A 0A 0A AA
5170  68 8C AC 85 AC 8D 08 90 8D 0C
5180  90 98 48 A2 07 20 9D 12 68 A8
5190  C8 C0 2C D0 D9 68 78 A9 15 A0
5200  14 02 A9 EB 8D 15 03 59 C0 A9
5210  03 85 FE 20 B7 12 A0 00 B9 2C
5220  94 29 8F 85 FF B9 2C 95 29 8F
5230  0A 0A 0A 0A 05 FF 8D DC 90 A2
5240  09 20 9D 12 C8 C8 0F D0 E1 C6
5250  FE D0 D3 20 B7 12 A9 96 8D 0C
5260  98 A0 0A EE 0C 90 A2 29 9D
5270  12 98 D0 F5 A0 0C 90 18 C9 00
5280  8D 0C 90 C9 DC 90 EE 4C 37 13
5290  57 51 A0 85 A0 8F 96 95 92 20
5300  A6 11 A0 00 A9 00 99 38 96 B9
5310  AA 14 99 B8 1E A2 00 20 9D 12
5320  C8 C0 09 D0 EB 60 C6 AF D0 27
5330  A9 01 8F A6 90 D0 38 94 29 8F
5340  8F 14 D0 38 95 29 8F 0A 0A
5350  0A 0A 85 14 8D 08 90 E6 D0 85
5360  D0 C9 18 D0 04 A9 00 85 D0 4C
5370  6C 15 82 1E 00 00 1E 82 1F 1F
5380  04 62 1F 96 50 1E 00 94 1F 02
5390  EE 1E 04 F6 1E A6 A2 00 A0 00
5400  BD FC 14 99 BC 02 E8 C8 BD FC
5410  14 99 BC 02 E8 C8 C0 C8 D0 D6
5420  99 BC 02 C8 A9 21 99 BC 02 C8
5430  E0 10 D0 DE 60 A0 00 B1 04 D0
5440  07 85 A4 F0 03 A2 00 60 A2 01
5450  60 00 0A 0A 0A A0 00 A2 00 95
5460  BE 02 E8 E8 E8 E8 E8 E8 D0 F5
5470  60 01 12 01 92 EA EA EA EA EA
5480  EA EA EA EA EA EA EA EA 03 4C 15
5490  E8 85 85 85 D6 A9 00 85 B4 A6
5500  BD BF 02 F0 4F C9 03 D0 4B 86
5510  FE 20 04 13 A6 FE B3 BC 02 85
5520  00 BD BD 0C 85 09 A4 AC 39 9F
5530  15 30 0F 85 00 18 79 5F 15 90
5540  02 E6 09 85 00 18 90 12 39 5F
5550  15 29 7F 85 FE A5 00 38 E5 FE
5560  B0 02 C6 00 85 00 A0 00 B1 00
5570  C9 00 D0 BF BD BE 02 29 FC 85
5580  AC 9D 3E 02 BD BE 02 29 03 85
5590  AC BD 3C 02 85 00 B3 BD 02 85
5600  09 BD 3F 02 A0 00 C9 01 F0 0E
5610  91 08 A5 09 18 69 78 85 09 B3
5620  C8 02 91 00 A4 AC 39 5F 15 30
5630  12 BD 3C 02 18 79 5F 15 30 03
5640  FE BD 02 9D 3C 02 18 90 15 B9
5650  5F 15 29 7F 85 FE BD 3C 02 38
5660  E5 FE B0 03 DE BD 02 9D 3C 02
5670  85 00 BD BD 02 85 09 A0 00 B1
5680  00 9D 3F 02 A4 01 91 00 85 09
5690  18 69 78 85 09 B1 00 3D 02 07
5700  BD BE 02 29 0C 4A EA 91 08 E6
5710  84 85 A4 C5 B1 F0 00 E8 E8 E8
5720  E8 E8 4C 70 15 4C 15 E8 A9 00
5730  8D BE 02 8D D0 02 A9 04 8D C3
5740  02 8D D7 02 A9 00 8D C8 02 8D
5750  D0 02 A9 0C 8D CD 02 8D E1 D0
5760  0A A6 0C C9 A6 D0 D0 D0 A0 A0
5770  A0 A0 00 BD 00 13 99 D0 1D E8
5780  C8 C0 20 D0 F4 60 20 4C 14 20
5790  B7 12 A9 00 85 B4 A4 B3 BC 02
5800  85 08 BD BD 02 85 09 BD BF 02
5810  A0 00 C9 FD 0E 91 00 85 04
5820  18 69 78 85 09 B0 D0 02 91 00
5830  E8 E8 E8 E8 E8 E8 A4 B4 C6 B4
5840  91 00 D0 02 E8 B0 01 1E C9 20
5850  F0 09 B0 01 9E 29 0F C9 01 F0
5860  15 B0 EC 1E C9 20 F0 09 B0 EC
5870  96 29 0F C9 01 F0 05 C9 00 D0
5880  F0 02 91 00 A0 FF C9 00 90
```

(listing continued on page 107)

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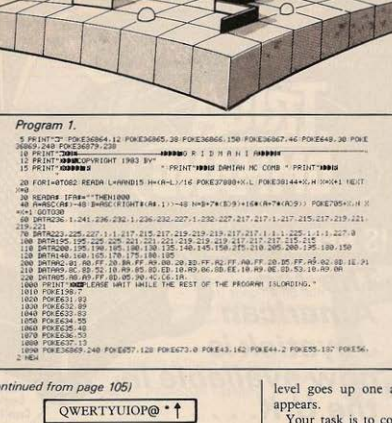


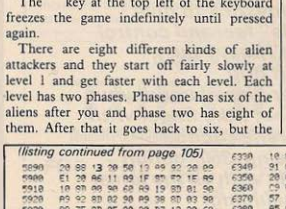
Program 1.

```
5 PRINT"?": POKE36864,12:POKE36865,38:POKE36866,150:POKE36867,46:POKE648,30:POKE
36869,240:POKE36879,239
10 PRINT"[redacted]0 R I D H A N I [redacted]
12 PRINT"[redacted]OPYRIGHT 1983 BY"
15 PRINT"[redacted]" :PRINT"[redacted] DAMIAN MC COMB :PRINT"[redacted]
20 FOR1=0TO82:READA:L=ANDI15:H=(A-L)/16:POKE37888+X,L:POKE38144+X,H:NEXT
X=0
30 READN#:IF#="THEN10000
40 A=ASC(A#)-48:B=ASC(B#)-48:N=B+7*(B>9)+16*(A+7*(A>9)):POKE705+X,N:X
=X+1:GOTO30
60 DATA236,1,241,236,232,1,236,232,227,1,232,227,217,1,217,215,217,215,217,219,221,
219,227
70 DATA223,225,227,1,217,215,217,219,219,219,217,217,1,1,1,225,1,1,1,227,0
100 DATA195,195,225,225,221,221,221,219,219,219,217,217,217,215,215
110 DATA200,195,190,185,180,170,155,148,145,150,215,210,205,200,195,180,150
120 DATA140,140,165,170,175,180,185
200 DATA2,01:A0,FF,20,BA,FF,A9,00,20,BD,FF,A2,FF,A0,FF,20,D5,FF,A2,01:E,P1
210 DATA99,8C,80:52,10,A9,85,8D,E0,10,A9,8C,8D,E1,10,A9,0E,D3,53,A9,0A
220 DATA05,00,A9,FF,D0,05,20,4C,C6,10
1000 PRINT"[redacted]PLEASE WAIT WHILE THE REST OF THE PROGRAM ISLOADING."
1010 POKE198,7
1020 POKE631,89
1040 POKE632,89
1040 POKE633,83
1050 POKE634,55
1060 POKE635,48
1070 POKE636,53
1080 POKE637,13
1090 POKE36869,240:POKE657,128:POKE73,0:POKE43,162:POKE44,2:POKE55,180:POKE56,
2:NEW
```

Modified loader.

```
0 REM FOR "#" READ INVERSE POUND SIGN
1 POKE36,15:POKE90,15:POKE55,250:POKE51,250:CLR
5 POKE36879,15
6 DIMA#(15):FOR1=0TO15:READA#(I):NEXT
7 DATA0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
10 POKE36879,25:PRINT"[redacted]MACHINE CODE LOADER      FOR GRIDMANIA
20 PRINT"[redacted]MENU[redacted]
30 PRINT"[redacted]  [redacted] [redacted]  [redacted]ENTER CODE"
40 PRINT"[redacted]  [redacted]  [redacted]  [redacted]LIST CODE"
50 PRINT"[redacted]  [redacted]  [redacted]  [redacted]RUN CODE"
60 PRINT"[redacted]  [redacted] [redacted]  [redacted]SAVE CODE"
70 POKE198,0:WAIT198,1:GETZF:IFZF=CHR$(13)+"RORVELC2E":4THEN70
80 OPEN4,(2#:GOTO1000,2000,3000,4000
1000 GOSUB10000:PRINT"#"
1010 PRINT"#";:INPUT2#:IF2#="END"THENRUN
1020 GOSUB20000
1030 IFH=-1THEN1010
1040 POKES,N:N=S+1:GOTO1010
2000 GOSUB10000:PRINT"#"
2010 C1=INT(PEEK(S9)/16)-C2+PEEK(S8)+C1*16:H#=H#+(C1)+H(C2)
2020 PRINT"[redacted]S:H#:S=S+1:POKE198,0:WAIT198,1:GETZ#
2030 IFZ#=" "THEN2010
2040 RUN
3000 POKE8,PEEK(45):POKE9,(46):PRINT"[redacted]P"45,P"(8):PF46,P"(1):RUN[redacted]
3010 POKE198,2:POKE631,19:POKE632,13:LOAD"",1,1
4000 GOSUB10000:GOSUB20000
4010 IFEE<=STHEN6000:S=S+1:GOTO4010
4020 FOR1=0TO3:POKE1:PEEK(42+I):NEXT:PRINT"[redacted]P"43,P"(0):PF44,P"(1):PF45,P"(2):P
746,P"(3):RUN"
4030 A#=S-INT(S/256)-B#=S-256*A#-1:CO=INT(EE/256):DD=EE-256*CO+1
4040 POKE198,2:POKE631,19:POKE632,13:POKE73,A#:POKE74,B#:POKE675,CO:POKE676,D
D
4050 POKE44,PEEK(673)/POKE43,PEEK(674):POKE46,PEEK(675)/POKE45,PEEK(676):SAVE""
,1,1:END
10000 PRINT"INTENDER START ADDRESS":INPUTS$:IFSS$=0RSS$>57600THENRETURN
10010 PRINT"ILLEGAL ADDRESS!!":POKE36874,160:FOR00=0TO999:NEXT:POKE36874,0:GOT
O10000
20000 IFLEN(Z#)<2THEN20020
20010 A#=ASC(Z#)-48:B#=ASC(RIGHT#(Z#,1))-48:N=B+7*(B>9)+16*(A+7*(A>9)):RETURN
20020 PRINT"BIG DIGITS!!":POKE36874,170:FOR00=0TO999:NEXT:POKE36874,0:N=-1:RETU
RN
30000 PRINT"ENTER END ADDRESS":INPUTEE:IFEE>40999ANDEE<57600THENRETURN
30010 PRINT"ILLEGAL ADDRESS!":POKE36874,160:FOR00=0TO999:NEXT:POKE36874,0:GOT
O30000
```

(continued from page 105)



The key at the top left of the keyboard freezes the game indefinitely until pressed again.

There are eight different kinds of alien attackers and they start off fairly slowly at level 1 and get faster with each level. Each level has two phases. Phase one has six of the aliens after you and phase two has eight of them. After that it goes back to six, but the level goes up one and a new kind of alien appears.

Your task is to completely cover the white grid with black and then to return to home base in the quickest time. If you return to base before completing the grid you will lose a life. You cannot destroy the pursuing aliens so you must avoid them.

As if this wasn't enough against you there is also a continually decreasing energy supply at the bottom of the screen. If this falls empty you lose a life. However when you complete a grid and return to base you will get a bonus for remaining energy. You will have to be quick though since this is the only way you can score.

The lowest high-score the game will register is 1500 and you also gain a free life at this score.

Incidentally you can speed up or slow down the game with the following two locations:

6131 = speed of your grid glider.
14 is normal, any less is faster
6057 = speed of aliens.
14 is normal.

In order to change these you will have to delete the part of program one which disables the run stop/restore; i.e. the last five items of data in line 200 — A9,02,8D,1E,91.

Whenever you do break out of the game, to resume play SYS 5915.

I have a cassette available containing Gridmania, for £4.00 at the following address: Gridmania Offer, 23 Woodlawn Drive, Dungannon, Co. Tyrone, BT70 1AJ.

There is also a cassette of my Flying Saucer Attack program for £3 from the same address.

(listing continued from page 105)

```
5580  01 88 13 20 9D 15 A5 97 D0 D0
5590  E1 88 A6 11 D0 1F 85 FD 1E 86
5910  10 D0 D0 D0 68 A9 19 8D 01 90
5920  A9 92 8D 02 90 A9 38 8D 03 90
5930  A5 7F 8D 0F 90 20 57 12 20 68
5940  16 A9 DC 85 05 A9 05 85 02 A5
5950  FF 8D 05 90 A9 00 85 04 A1
5960  20 F0 16 A9 FF 85 00 A9 00
5970  A9 06 01 00 A0 04 91 00 A4
5980  85 FC 20 14 16 A9 92 20 09
5990  20 A6 11 20 50 13 A9 05 85
5000  20 81 16 A9 00 A0 00 A9 10
5010  9D 00 90 A5 FC 20 09 FC 20
5020  16 A6 11 A9 00 A0 05 8C 00
5030  FF 20 4C 14 A9 FF A0 05 20
5040  85 FC 20 14 A9 FF A0 00 A0
5050  85 FC 20 14 A9 FF A0 00 A0
5060  A9 10 8D 00 90 A9 00 A0 00
5070  20 53 14 20 71 12 20 26 12
5080  0F 8D 0F 90 20 87 12 20 14
5090  A6 81 9D 00 14 A9 1C 85 04
5100  15 04 A9 A9 A9 8F A5 A5 A5
5110  A9 04 A9 04 A9 04 A9 04 A9
5120  0E 19 85 06 C5 C1 D0 07 C6
5130  D0 E7 D0 D7 8D 00 A5 06 D0
5140  A9 01 A9 04 A9 04 A9 04 A9
5150  A9 19 85 C1 A5 D0 A9 04 A9
5160  D0 C9 01 D0 04 A9 01 D0 04
5200  C9 12 D0 04 A9 02 D0 02 A9
5210  0A 8A 8A A9 00 8D 08 19 A9
5220  10 1C E8 C8 D0 04 A5 D0 A5
5230  85 8F 85 85 85 10 A5 C1 30 0E
5240  85 8F 18 85 C1 30 A5 E6 10 85
5250  8F 18 30 11 A5 C1 A5 D0 A5 F8
5260  A5 8F 18 85 C1 A5 D0 A5 F8 A5
5270  8F A0 00 31 8F C9 1F D0 03 4C
5280  1E 19 C9 00 90 03 4C F2 17 C9
5290  01 D0 03 4C 1E 19 A9 02 85 97
5300  85 97 A0 00 91 A4 91 8F 85 97
5310  A9 00 91 8F 85 97 C9 78 85 97
5320  85 A9 00 91 04 85 8F 85 04 85
```

```
5330  10 85 05 18 69 78 85 10 A9 06
5340  91 8F 4C F2 17 E8 E8 E8 E8 E8
5350  20 8F 14 20 4C 14 C6 85 85 85
5360  C9 FF D0 03 4C 50 17 A2 04 20
5370  57 12 A2 50 20 99 12 85 00 48
5380  85 01 48 A5 05 48 A5 48 85 85
5390  0C 48 20 FF 16 68 85 0C 68 85
5400  A6 68 85 85 68 85 01 68 85 00
5410  20 71 12 20 26 12 A2 04 20 57
5420  12 20 05 14 4C 89 17 E8 E8 E8
5430  A9 00 8D F2 96 20 9A 16 E0 01
5440  D0 03 4C 1E 19 A3 C9 20 90 12
5450  20 C3 12 E6 81 E6 81 96 91 C5
5460  A0 D0 0C 96 95 91 E6 0C 85
5470  85 C9 00 F8 02 C6 85 4C E9 18
5480  FF F8 02 C6 85 4C E9 18 FF E5
5490  04 85 00 88 50 0C 82 F0 00 20
5500  93 12 10 0C C6 C6 C6 C6 C6 C6
5510  C6 C6 C6 C6 C6 C6 C6 C6 C6 C6
5520  C6 C6 C6 1C 1D 1D 1D 1D 47 20
5530  52 20 49 20 44 20 4D 20 41 20
5540  4E 20 49 20 41 20 1D 1D 1D 05
5550  C5 C5 C5 C5 C5 C5 C5 C5 C5 C5
5560  C5 C5 C5 C5 C5 C5 C5 C5 C5 C5
5570  11 1D 1D 1D 1D 1D 1D 1D 1D 1D
5580  42 59 20 44 41 4D 49 41 4E 20
5590  C8 C8 C8 C8 C8 C8 C8 C8 C8 C8
5600  C8 C8 C8 C8 C9 1D 1D 1D 1D 1D
5610  D0 90 92 25 26 27 28 26 29 28
5620  20 27 28 26 29 28 20 1D 1D 12
5630  1D 1D 1D 1D 1D C8 C8 C8 C8 C8
5640  C8 C8 C8 C8 C8 C8 C8 C8 C8 C8
5650  C8 C8 C8 11 11 1D 1D 1D 1D 1D
5660  1D 1D 1D 1D 1D 1D 1D 1D 4F 4C
5670  53 20 00 12 1E 1D 1D 1D 1D 1D
5680  B7 B7 B7 B7 B7 B7 B7 B7 B7 B7
5690  B7 B0 1D 1D 85 55 50 9E 2E 2E
5700  2E 2E 90 51 57 45 52 54 59 55
5710  49 4F 50 40 00 12 1D 1D 85 44
5720  4F 57 4E 9E 2E 2E 2E 90 5A 58
5730  43 56 42 4E 4D 2C 2E 2F 00 12
5740  1D 1D 85 4C 45 46 54 9E 2E 2E
5750  2E 2E 2E 2E 2E 90 41 53 44 46
5760  47 48 00 1D 1D 05 52 49 47 48
5770  54 9E 2E 2E 2E 2E 2E 2E 90 4A
```

```
5780  4B 4C 3A 3B 3D 00 11 1D 1D 1D
5790  1F 4F 52 20 55 53 45 20 4B 4F
5800  59 53 54 49 43 4B 00 11 1D 1C
5810  50 52 45 53 53 20 41 20 43 45
5820  20 54 4F 20 53 54 41 52 54
5830  00 12 19 64 19 A6 19 B8 19 FE
5840  1A 11 1A 24 3B 1A 53 1A 63
5850  1A 82 1A 97 A9 A0 8D 0F 90 A9
5860  00 85 FA A5 FA 0A AA BD B0 1A
5870  BD B1 1A 20 1E C8 A9 00 20
5880  09 E1 A9 12 20 09 E1 E6 FA A5
5890  FA C9 08 D0 E0 A9 01 85 D6 A5
5900  C5 C9 40 F0 FA 4C 18 17 F8 13
5910  56 C6 7E F9 F1 01 FF FF 7E
5920  7E FF 8F FF FF F9 F8 7E 7E E7
5930  E7 E7 E7 E7 7E 7E FF F8 F7
5940  EF 8F FF 7E 13 3F 42 DB D8 42
5950  DB 8F D0 FF 20 13 C3 42 FF DB
5960  DB FF 42 DD DB F8 DB DB DB 7A
5970  42 C9 C3 42 3F 1B FF 87 87 9F
5980  9F FF FF FF FF FF C1 F9 F9 FF
5990  FF FF FF FF FF FF F9 F1 E1 FF
5000  FF FF FF 9F 9F 87 87 FF 3C 3C
5010  FF A5 A5 FF 3C 3C 3C 24 FF FF
5020  FF 24 3C 3C 3C FF BD BD FF
5030  3C 3C 3C FF E7 FF 24 3C 3C
5040  7E FF 7E DD 99 7E 7E FF
5050  C3 FF BB 99 7E 7E E7 C3 E7
5060  FF 99 BB 7E 7E C3 81 C3 FF 99
5070  DD 7E 18 7E 7E C3 E7 5A 7E 18
5080  18 7E 42 DD DB 42 7E 18 18 7E
5090  66 C3 C3 66 7E 18 18 7E 7E 18
5100  E7 7E 7E 10 19 26 46 E9 F1 7A
5110  3C 10 98 64 62 93 8F 4E 3C 18
5120  3C 4E 8F 92 62 64 98 18 3C
5130  72 F1 C9 46 26 19 F8 F0 C0 D9
5140  D8 C3 FF FF FF FF C3 DB D9 C0
5150  F8 F0 FF FF C3 DB 98 83 8F 1F
5160  1F 8F 83 98 DB C3 FF FF 18 18
5170  3C 18 3C 7E FF DB 7E 99 BB FF
5180  FF FF 7E 00 00 00 00 0F 1F 1C
5190  18 18 00 00 00 FF FF 18 18 18
5200  00 00 00 F0 F8 38 18 18 18 18
5210  18 F8 F8 18 18 18 18 18 38 F8
5220  F0 00 00 00 18 18 FF FF 00
```

```
7230  00 00 18 18 1C 1F 0F 00 00 00
7240  18 18 18 1F 1F 18 18 18 18 18
7250  3C E7 E7 3C 18 18 18 18 18 18
7260  18 18 18 18 00 00 00 FF FF 00
7270  00 00 FF AA AA AA AA AA FF 00
7280  FF AA AA AA AA AA FF 00 FF AF
7290  AF AF AF FF 00 FF BF BF BF
7300  BF BF FF 00 FF FF FF FF FF FF
7310  FF 00 00 C0 89 D2 52 52 C9 00
7320  00 00 33 AA D3 AA 2B 00 00 AB
7330  AE E4 A4 A4 AF 00 00 00 65 85
7340  B7 95 65 00 00 00 00 00 89 8D 89
7350  EC 00 00 00 5A 52 5A 52 5B 00
7360  00 00 8A 8A 8A 8A E9 00 00 00
7370  B6 A4 B6 A2 36 00 00 E0 84 C8
7380  8A EA 00 00 00 00 EC 8A EC 8A
7390  EA 00 00 00 65 85 B7 92 62 00
7400  9E 42 10 00 21 8E 42 10 04 00
7410  9B 3C 3D 18 00 10 7E C3 BD BD
7420  BD BD C3 7E 00 00 00 00 00 00
7430  00 00 18 18 3C 18 3C 7E FF DB
7440  C0 E0 74 FF FF 74 E0 C0 DB FF
7450  7E 3C 18 3C 18 18 03 07 2E FF
7460  FF 2E 07 03 00 FC 82 BA BA BA
7470  82 FC 00 7C 82 BA 82 BA AA EE
7480  00 7C 82 BA 82 BA AA FE 00 00
7490  82 EE 28 EE 82 FE 00 7C 82 BA
7500  AA AA AA EE 00 7C 82 BE 00 BE
7510  82 7E 00 7C 82 BA AA BA 82 7C
7520  7E FE C3 C3 FF C3 FF C3 C3 FF
7530  BD BD BD BD C3 7E C3 BD A5
7540  BD C3 7E C3 81 99 99 81
7550  C3 7E 7E 7E 66 66 66 7E 7E
7560  18 18 10 10 18 18 18 7E 7E
7570  06 7E 7E 40 7E 7E 7E 06 7E
7580  06 7E 7E 60 60 6C 6C 7E 7E
7590  0C 0C 7E 7E 60 7E 7E 06 7E 7E
7600  60 60 60 7E 7E 66 7E 7E 7E 7E
7610  06 0E 1C 38 30 30 7E 7E 42 7E
7620  7E 42 7E 7E 7E 42 7E 7E 06
7630  06 06 7E FF FF FF FF DD 99 7E
7640  7E FF C3 FF FF DB 99 7E 7E E7
7650  C3 E7 99 BB 7E 7E C3 81 C3
7660  FF 99 DD 7E 00 FF 81 B9 82 B9
7670  81 FE 03 13 03 03 03 13 03
```

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It is impossible to describe all the features of this amazing program in such a small space so we have produced a demonstration cassette which gives further information and an example of its use. This cassette is available at £2.00 and the Quill itself is £14.95.

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TERMINAL

ZX-81 SIMD

Program 1.

```
10 REM PROGRAM 1
20 SAVE "PROGRAM 1"
30 POKE 16388,44
40 POKE 16389,126
50 PRINT AT 5,0;"RAMTOP IS SET
AT ADRESS 32300".
60 PRINT AT 21,4,"PRESS ANY KE
Y"
70 IF INKEY$="" THEN GOTO 70
80 NEW
```

Figure 1.

```
32300  CD2A0A   CALL 2602
32303  11777E   LD DE,32575
32306  011600   LD BC,22
32309  CD6608   CALL 2923
32312  010003   LD BC,765
32315  CDF608   CALL 2293
32318  11B07E   LD DE,32397
32321  011300   LD BC,19
32324  CD6608   CALL 2923
32327  3E76     LD A,118
32329  D7       RST 16
32330  D7       RST 16
32331  11A07E   LD DE,32416
32334  2E03     LD L,3
32336  010300   LD BC,3
32339  CD6608   CALL 2923
32342  3E76     LD A,118
32344  D7       RST 16
32345  2D       DEC L
32346  20F4     JRNZ 244
32348  CDB002
                CALL 699
32351  44       LD B,H
32352  4D       LD C,L
32353  51       LD D,C
32354  14       INC D
32355  20F7     JRZ 247
32357  CDB007   CALL 1981
32360  7E       LD A (HL)
32361  FE1F     CP A,31
32363  C8       RETZ
32364  FE1D     CP A,29
32366  CA047F   JPZ 32516
32369  FE1E     CP A,30
32371  20E7     JRNZ 231
32373  1032     JR 50
32375          DATA SIMD
32379          DATA OS -
32383          DATA BY
32387          DATA J.L.
32391          DATA DELM
32395          DATA EZCH
32399          DATA DOSE
32403          DATA ONE
32407          DATA OF
32411          DATA INES
32415          DATA E1.LOAD
32419          DATA 2.SAVE 3
32423          DATA .RETURN
32425  218140   LD HL,16513
32428  7E       LD A,(HL)
32429  FEER     CP A,234
32431  201A     JRNZ 26
32433  017761E  LD BC,7798
32436  23       INC HL
32437  7E       LD A,(HL)
32438  FE00     CP A,0
32440  2504     JRZ 4
32442  FE05     CP A,11
32444  380D     JRC 13
32446  B9       CP A,C
32447  2032     JRZ 50
32449  CB77     BIT 6,A
32451  2005     JRNZ 6
32453  CB7F     BIT 7,A
32455  2002     JRNZ 2
32457  10E9     DJNZ 233
32459  3E76     LD A,118
32461  D7       RST 16
32462  D7       RST 16
32463  011000   LD BC,26
32466  11D97E   LD DE,32473
32469  CD6608   CALL 2923
32472  C9       RET
32473          DATA ERRO
32477          DATA R IL
32481          DATA LEGA
32485          DATA L PR
32489          DATA OGRA
32493          DATA M-NA
32497          DATA ME
32499  78       LD A,B
32500  FE1E     CP A,30
32502  28D3     JRZ 211
32504  217D40   LD HL,16509
32507  00       NOP
32508  00       NOP
32509  00       NOP
32510  00       NOP
32511  36FF     LD (HL),255
32513  C3DA7F   JP 32730
32516  217D40   LD HL,16509
32519  7E       LD A,(HL)
32520  FE76     CP A,118
32522  281F     JRZ 32
32524  FEFF     CP A,255
32526  263B     JRZ 59
32528  3E76     LD A,118
32530  D7       RST 16
32531  D7       RST 16
32532  11E7F    LD DE,32542
32535  010000
                LD BC,13
32538  CD6608   CALL 2923
32541  C9       RET
32542          DATA FIRS
32546          DATA TSAVE PR
32550          DATA OGRA
32554          DATA M
32555  D7       RST 16
32556  D7       RST 16
32557  11277F   LD DE,32567
32560  011400   LD BC,20
32563  CD6608   CALL 2923
32566  C9       RET
32567          DATA NO P
32571          DATA ROGR
32575          DATA AM A
32579          DATA VAIL
32583          DATA ABLE
32587  CD2A0A   CALL 2602
32590  217D40   LD HL,16509
32593  1600     LD D,0
32595  14       INC D
32596  7E       LD A,(HL)
32597  FEER     CP A,234
32599  33       INC HL
32600  20FA     JRNZ 250
32602  7A       LD A,D
32603  C61C     ADD A,28
32605  D7       RST 16
32606  97       SUB A,A
32607  D7       RST 16
32608  7E       LD A,(HL)
32609  D7       RST 16
32610  23       INC HL
32611  FE76     CP A,118
32613  20F9     JRNZ 249
32615  7E       LD A,(HL)
32616  FEFF     CP A,255
32618  28E7
                JRZ 231
32620  FE76     CP A,118
32622  2809     JRZ 9
32624  23       INC HL
32625  7E       LD A,(HL)
32626  FE76     CP A,118
32628  20FA     JRNZ 250
32630  23       INC HL
32631  18EE     JR 238
32633  D5       PUSH DE
32634  CDB002   CALL 699
32637  44       LD B,H
32638  4D       LD C,L
32639  51       LD D,C
32640  14       INC D
32641  20F7     JRZ 247
32643  CDB007   CALL 1981
32646  7E       LD A (HL)
32647  D61D     SUB A,29
32649  38EF     JRC 239
32651  D1       POP DE
32652  BA
                CP A,D
32653  30EA     JRNC 234
32655  CDE702   CALL 743
32658  217D40   LD HL,16509
32661  FE00     CP A,0
32663  2811     JRZ 17
32665  5F       LD E,A
32666  23       INC HL
32667  7E       LD A,(HL)
32668  FE76     CP A,118
32670  20FA     JRNZ 250
32672  23       INC HL
32673  7E       LD A,(HL)
32674  FEFF     CP A,255
32676  20F4     JRNZ 244
32678  7B       LD A,E
32679  3D       DEC A
32680  18EB     JR 235
32682  117D40   LD DE,16509
32685  AF       X-OR A
32686  EDS2     SBC HL,DE
32688  E5
                PUSH HL
32689  C1       POP BC
32690  78       LD A,B
32691  B1       OR A,C
32692  2819     JRZ 25
32694  C5       PUSH BC
32695  117D40   LD DE,16509
32698  1A       LD A,(DE)
32699  2A0C40   LD HL,(16396)
32702  2B       DEC HL
32703  E5       PUSH HL
32704  EDS2     SBC HL,DE
32706  E5       PUSH HL
32707  C1       POP BC
32708  D5       PUSH DE
32709  E1       POP HL
32710  23       INC HL
32711  EDB0     LDIR
32713  E1       POP HL
32714  77       LD (HL)A
32715  C1       POP BC
32716  0B       DEC BC
32717  18E3     JR 227
32719  217D40   LD HL,16509
32722  3600     LD (HL),0
32724  222940   LD (16425),HL
32727  23       INC HL
32728  3601     LD (HL),1
32730  3E76     LD A,118
32732  D7       RST 16
32733  D7       RST 16
32734  11ED7F   LD DE,32747
32737  010500   LD BC,5
32740  CD6608   CALL 2923
32743  CD0702   CALL 519
32746  C9       RET
32747          DATA READ
32751          DATA Y
```

Program 2.

```
10 REM PROGRAM 2
30 PRINT "HEX-CODES
     FROM FIGURE 1
30 PRINT "MACHINE CODE LOADER"
40 PRINT
50 LET J=32300
55 LET C=J
60 LET C$=""
70 IF C$="" THEN INPUT C$
80 IF C$(1)="$" THEN GOTO 150
90 POKE J,16*CODE C$+CODE C$(2
)-476
100 GOSUB 240
110 PRINT C$( TO 2)," ",
120 LET J=J+1
130 LET C$=C$(3 TO )
140 GOTO 70
150 LET C$=C$(2 TO )
160 IF C$(1)="$" THEN GOTO 220
170 POKE J,CODE C$
180 GOSUB 240
190 PRINT CHR$ (28+INT (CODE C$
/16)),CHR$ 128+CODE C$-16*INT (C
ODE C$/16)," ",
200 LET J=J+1
210 GOTO 150
220 LET C$=C$(2 TO )
230 GOTO 70
240 LET S=(J-Z)/8
250 IF S=INT S THEN PRINT ,J,"
"
260 RETURN
```

A DISC OPERATING system is a small part of the ROM that enables a computer to write and read programs on to and from a disc. The read or Load procedure is very fast as is the write or Save procedure. The Load procedure usually provides a menu of all the programs available from the disc.

Using this machine-code program for the 16K ZX-81 you can discover the ease of programming with a DOS — Disc Operating System. I have called it Simdos, an abbreviation for Simulated DOS. It allows for fast Loading and Saving without having to use a cassette or diskette.

Simdos is totally written in machine code so you can place it above RAMtop where it is protected against Clear and New. Type in program 1, start your tape recorder and Run.

Program 3.

```
10 REM PROGRAM 3
20 REM COMPARE THE HEX-CODES
     SHOWN WITH THOSE OF
     FIGURE 1.
30 PRINT "A CHECK ON THE HEX-C
ODES"
40 LET C=32300
45 LET D=C
50 PRINT C." ",
70 FOR J=1 TO 5
80 LET U=PEEK C
90 PRINT CHR$ (INT (U/16)+28),
CHR$ (U-16*INT (U/16)+28)," ",
100 LET C=C+1
110 NEXT J
120 PRINT " "
125 FOR V=D TO D+4
130 LET U=PEEK V
135 LET N=E
140 IF E>127 THEN LET N=E-128
150 IF N>63 OR N=0 THEN PRINT "
"
160 IF N<64 AND N>0 THEN PRINT
CHR$ E
170 NEXT V
180 GOTO 45
```

Program 4

```
1 REM AAAAAAAAAAAAAAAA
      (17 A"S)
2 REM PROGRAM 4
5 PRINT
10 LET C$="2B10401100001112C7
EE00FA01ED5C9"
20 FOR D=16514 TO 16530
30 POKE D,16*CODE C$+CODE C$(2
)-476
40 LET C$=C$(3 TO )
50 NEXT D
60 CLEAR
70 DIM A(100)
80 RAND USR 16514
90 SAVE "PROGRAM 4"
100 POKE 16524,0
110 RAND USR 16514
120 PRINT AT 8,0;"YOU HAVE SIMD
OS AT YOUR DISPOSAL"
130 PRINT AT 12,0; USE  RAND US
R 22300"
140 SLOW
```

DOS

Discover the ease of programming with a Disc Operating System on the ZX-81 with Carlo Delhez.

Whenever you want to use Simdos, Load this program which resets RAMtop to address 32300. Now you can start entering the hex codes in figure 1, using program 2 — a normal hex loader with one extra advantage: when data has to be entered, you do not have to type the hex codes corresponding with the data. You just type the data preceded and ended by a dollar-sign.

So, when you want to enter Simdos as data, you do not have to type 382E32293438 — the hex codes for the individual letters — but simply $SIMDOS$. This facilitates entering data. The Load, Save and Return statements in the data at address 32418 can be obtained from the keyboard by typing Then, followed by the statement concerned and finally by deleting the keyword Then and putting the cursor back in its correct position. Figure 1 contains all the machine-code instructions and every four bytes of data is provided with an address-indication, so you can check whether or not you have forgotten one or more bytes or double-typed some.

If you think you have mistyped a byte, break into the program by inputting Stop. You will get an error-message, but do not bother about that. Make a note of the address at which you made your mistake, list, edit line 50 and change 32300 into your address. When you Run again you can start entering the hex-codes from this address onwards. After having entered all the hex-codes and data you will have to subject the program to a final test by means of program 3.

Check everything very carefully as one little error might cause an irretrievable program-crash. Once you have tested all the bytes for accuracy, you can Save them.

This has to be done with a special program as the position of RAMtop and the bytes above it are not Saved by the Basic-Save. Program 4 uses machine code to copy a block of bytes into array A, then Saves the program and again uses machine code to copy the contents of A, placing them in their proper positions, starting at address 32300.

The machine-code program to achieve this is shown in figure 2. The second time this machine code is used the Ex de,hl is changed into Nop. If you have done everything as described, the program can be Run.

Simdos offers three possibilities after being executed. I will discuss them one by one.

Save: One stipulation that has to be met is to include a program-name. This name has to be put behind a Rem-statement in the first line of the program. It must contain at least one and at most 30 characters which all have to have a code between 10 and 64. Spaces are also allowed.

An error-message is displayed if the first line does not contain a Rem statement or the number of characters behind the Rem is too small or too large or illegal characters are found. If all is correct, the program is Saved. On return the program can neither be seen, or Run.

Simdos-Load will put it back into visible memory. If you have machine code stored in the first line here is a hint for you on how to adapt it: First type Poke 16510,2. This instruction transfers the first line, the one with the machine code, to line 2. If you already have a line 2 in your program this will not be swallowed by the new line 2.

Next, add line 1 including the program name. To Run the machine code — in the second line — use Rand USR (x+4+Peek 16511) instead of Rand USR x, where x is something around 16514. You will have to go through your Basic and machine-code program to change the addresses that are called by USR and Call.

For example, if you give a certain program the name Name then Peek 16511 equals 6. The machine code that first started at address 16514, now starts at address x+4+Peek 16511 or 16514+4+6 = 16524. If you want to Save a Program without having to pass the menu, use Rand USR 32425.

Load: Having Saved several programs using the above routine, you will probably want to reload them. This can be done employing Simdos-Load: after having executed Rand USR 32300 just choose Load. Now the computer will display a menu, showing all the programs available.

Pick out one of them by pressing the key corresponding with the number — or letter if there are more than nine programs on the menu — in front of the name. The program will now continue in fast mode and Load the program preferred. Although the Loading goes very, very fast it still might take a little while.

Once the program has been loaded it is automatically executed. If you do not want this automatic run, just type Poke 32726,0 and to regain this facility Poke 32726,64. Error messages are given when no programs are available from the disc or when the program currently in memory is not saved yet.

- When one program is Saved and another Loaded, all the variables used with the first stay intact. You can use this with different programs to generate and manipulate strings.
- The programs are stored above each other, all before the display-file, that is shifted up each time you add a program.

  After being Run program 5 will show all the programs stored.
- New will destroy the total contents of the disc, not only the one that can be seen.
- When USR 32425 or Save is executed within the program, the execution continues until a Goto, Gosub or Run statement is found; then the computer will stop with an end-of-execution message. List and LList are always ignored after Simdos-Save.
- To save a disc on cassette I should use program 6. The machine code is not Saved by the Basic-Save-Use program 4 instead.
- It is best to put all the full "discs" on one cassette, preceded by program 1 — which resets RAMtop — and program 4 which Loads the machine code above RAMtop.

If you have any questions write to me: Carlo Delhez, Emmastreet 3, 4651 BV Steenbergen, Holland. Please include £1 sterling.

Program 5.

```
  1 REM PROGRAM 5
 10 FOR X=16509 TO PEEK 16396+2
56+PEEK 16397
 20 PRINT CHR$ PEEK X,
 30 NEXT X
```

Program 6.

```
 1 REM DISK-SAVE
 2 REM PROGRAM 6
10 RAND USR 32425
20 SAVE "DISK"
30 RAND USR 32300
```

Figure 2

```
16514   2A1040      LD HL,(16400)
16517   118600      LD DE,6
16520   19          ADD HL,DE
16521   112C7E      LD DE,32300
16524   EB          EX DE,HL
16525   01F401      LD BC,500
16528   EDB0        LDIR
16530   C9          RET
```

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SPRITE EDITOR

THIS IS HOW THE SCREEN SHOULD APPEAR WHEN YOU RUN THIS PROGRAM

SPRITE EDITOR

PRESS CTRL+E TO EXIT

This program by Njal Fisketjøn makes it easy to create sprites of all kinds on the Commodore CBM 64.

***: FILL BOX**

SPACE CLEAR BOX

F3: EXPAND XDIR YES/NO

F5: EXPAND YDIR YES/NO

F7: MULTICOLOUR YES/NO

F4: SELECT 1ST MULTICOLOUR

F6: SELECT 2ND MULTICOLOUR

F8: SELECT BACKGROUND COLOUR

CTRL/CBM KEYS CHANGE SPRITE COLOUR

F1: PRINT SPRITE DATA F2: DISPLAY ON/OFF

THIS PROGRAM LETS you create a sprite on the screen and display or print the necessary Data and Poke statements.

To change the colour of the sprite use the CBM or Ctrl key together with keys 1 to 8 just as you would do to change the colour of the cursor. To make the drawing of vertical lines easier there are four commands not shown on the display; U, R, D and L.

These change the direction in which the cursor will move after a ' ' or a '*' to up, right, down and left respectively.

Multicolour sprite

If you use a multicoloured sprite the resolution is 12 by 21 and each 'dot' in the sprite is represented by two dots in the large area.

' ' is the background colour.
' *' is 1st multicolour (0).
'* ' is foreground (sprite) colour.
'**' is 2nd multicolour (1).

Extended colour mode on the CBM 64 allows you to have four different background colours on the screen at once, but it also reduces the character set to the 64 first characters of the Poke set, ie, no graphics

Normal characters give background colour 1 : PEEK(53281).

Shifted characters give background colour 1 : PEEK(53282).

Reversed characters give background colour 2 : PEEK(53283).

Reversed shifted characters give background colour 3 : PEEK(53284).

If the printer makes the computer hang you should change these two lines

460 POKE 53265,PEEK(53265) AND 239
690 POKE 53265,PEEK(53265) OR 16

This will cause the screen to go blank while the computer is printing.

It is advisable to enter lines 2400 and 2410 only when you are sure that the program is working correctly.

```
10 REM FOR "£" READ INVERSE POUND SIGN
100 REM  SPRITE EDITOR ** COPYRIGHT 1983 BY NJAAL FISKETJON
110 GOSUB 2400
120 REM ********************************************************************
130 REM                              MAIN PROGRAM LOOP
140 REM ********************************************************************
150 GET A$ IF A$="" THEN 150
160 OK=0
170 P=PEEK(653) IF P=2 OR P=4 THEN 300
180 FOR K=1 TO 21
190 IF A$=MID$(FU$.K.1) THEN OK=1 GOTO 220
200 NEXT
210 GOTO 150
220 ON K GOSUB 450.740.1010.1340.1120.1460.1230.1580.1700
230 IF K<10 THEN 150
240 ON K-9 GOSUB 1700.1810.1900.1990.2060.2130.2220.260.270.280.290.2320
250 GOTO 150
260 DI=1 RETURN
270 DI=2 RETURN
280 DI=3 RETURN
290 DI=4 RETURN
300 A=PEEK(197) CO=-1
310 IF P=4 AND A=14 THEN 2260
320 IF P=2 THEN CO=7
330 IF A=56 THEN CO=CO+1 POKE 53288.CO GOTO 150
340 IF A=59 THEN CO=CO+2 POKE 53288.CO GOTO 150
350 IF A= 8 THEN CO=CO+3 POKE 53288.CO GOTO 150
360 IF A=11 THEN CO=CO+4 POKE 53288.CO GOTO 150
370 IF A=16 THEN CO=CO+5 POKE 53288.CO GOTO 150
380 IF A=19 THEN CO=CO+6 POKE 53288.CO GOTO 150
390 IF A=24 THEN CO=CO+7 POKE 53288.CO
400 IF A=27 THEN CO=CO+8 POKE 53288.CO
410 GOTO 150
420 REM ********************************************************************
430 REM          F1 PRESSED              PRINT SPRITE DATA
440 REM ********************************************************************
450 OPEN 4.4
460 POKE 53269.0
470 PL=100
480 FOR I=832 TO 894 STEP 9
490 PRINT#4.PL" DATA ".
500 FOR J=0 TO 7
510 PRINT#4.MID$(STR$(PEEK(I+J)).2)".".
520 NEXT
530 PRINT#4.MID$(STR$(PEEK(I+8)).2)
540 PL=PL+10 NEXT
550 PE=PEEK(53271) IF PE THEN PL=PL+10
560 IF PE THEN PRINT#4.PL" POKE 53271.2 REM EXPAND X-DIR"
570 PE=PEEK(53277) IF PE THEN PL=PL+10
580 IF PE THEN PRINT#4.PL" POKE 53277.2 REM EXPAND Y-DIR"
590 PE=PEEK(53276) IF PE THEN PL=PL+10
600 IF PE THEN PRINT#4.PL" POKE 53276.2 REM MULTICOLOUR"
610 PF=PEEK(53288) IF PF THEN PL=PL+10
620 IF PF THEN PRINT#4.PL" POKE 53288."MID$(STR$(PF).2)" REM SPRITE-COLOUR"
630 PF=PEEK(53285) IF PF AND PE THEN PL=PL+10
640 MZ$=" MULTICOLOUR"
650 IF PF AND PE THEN PRINT#4.PL" POKE 53285."MID$(STR$(PF).2)" REM 1ST"MZ$
660 PF=PEEK(53286) IF PF AND PE THEN PL=PL+10
670 IF PE AND PE THEN PRINT#4.PL" POKE 53286."MID$(STR$(PF).2)" REM 2ND"MZ$
680 FOR I=1 TO 5 PRINT#4 NEXT
690 POKE 53269.3
700 CLOSE4 RETURN
710 REM ********************************************************************
720 REM          F2 PRESSED              DISPLAY SPRITE DATA ON SCREEN
730 REM ********************************************************************
740 PRINT LEFT$(DW$.25)"[graphics]/$4/OFF".
750 PRINT "[graphics]".
760 POKE 53248.33 POKE 53249.66
770 FOR I=832 TO 894 STEP 3
780 FOR J=0 TO 2
790 PP$=MID$(STR$(PEEK(I+J)).2)
800 IF LEN(PP$)=1 THEN PP$="  "+PP$
810 IF LEN(PP$)=2 THEN PP$=" "+PP$
820 MF$=CHR$(ASC(LEFT$(PP$.1))+E(0))
830 MM$=CHR$(ASC(MID$(PP$.2.1))+E(0))
840 ML$=CHR$(ASC(RIGHT$(PP$.1))+E(0))
850 PP$=MF$+MM$+ML$
860 PRINT "[graphics]"PP$.
870 NEXT PRINT "[graphics]".
880 NEXT
890 GET A$ IF A$<>"[graphics]" THEN 890
900 PRINT LEFT$(DW$.25)"[graphics]ON/[graphics]—".
```

(listing continued on page 115)

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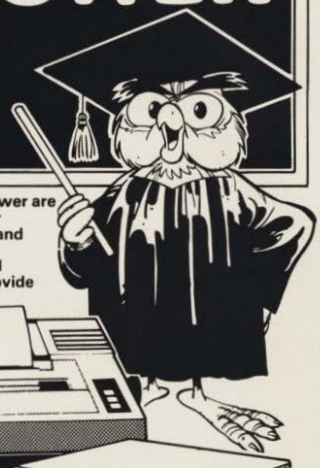

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(listing continued from page 113)

```
910 PRINT"■■■■".
920 FOR I=0 TO 20
930 PRINT LEFT$(S$(I).24)LEFT$(RI$.16)
940 NEXT PRINT "■".
950 POKE 53248.X*8+33
960 POKE 53249.Y*8+66
970 RETURN
980 REM ****************************************************************
990 REM         F3 PRESSED            EXPAND SPRITE IN X-DIRECTION
1000 REM ****************************************************************
1010 EX=PEEK(53277)
1020 IF EX<>0 THEN 1060
1030 POKE 53277.2
1040 PRINT LEFT$(DW$.12)LEFT$(LE$.11)"■■ ┌■■■NO".
1050 RETURN
1060 POKE 53277.0
1070 PRINT LEFT$(DW$.12)LEFT$(LE$.11)"■YES ■■ ┌■■".
1080 RETURN
1090 REM ****************************************************************
1100 REM         F5 PRESSED            EXPAND SPRITE IN Y-DIRECTION
1110 REM ****************************************************************
1120 EY=PEEK(53271)
1130 IF EY<>0 THEN 1170
1140 POKE 53271.2
1150 PRINT LEFT$(DW$.14)LEFT$(LE$.11)"■■ ┌■■■NO"
1160 RETURN
1170 POKE 53271.0
1180 PRINT LEFT$(DW$.14)LEFT$(LE$.11)"■YES ■■ ┌■■"
1190 RETURN
1200 REM ****************************************************************
1210 REM         F7 PRESSED            MULTICOLOUR SPRITE ON/OFF
1220 REM ****************************************************************
1230 EM=PEEK(53276)
1240 IF EM<>0 THEN 1280
1250 POKE 53276.2
1260 PRINT LEFT$(DW$.16)LEFT$(LE$.11)"■■ ┌■■■NO"
1270 RETURN
1280 POKE 53276.0
1290 PRINT LEFT$(DW$.16)LEFT$(LE$.11)"■YES ■■ ┌■■"
1300 RETURN
1310 REM ****************************************************************
1320 REM         F4 PRESSED            SELECT 1ST MULTICOLOUR OF SPRITE
1330 REM ****************************************************************
1340 M1=PEEK(53285) AND 15
1350 M1=M1+1 IF M1>15 THEN M1=0
1360 POKE 53285.M1 OR 240
1370 M1$=MID$(STR$(M1).2) IF M1<10 THEN M1$=" "+M1$
1380 MF$=CHR$(ASC(LEFT$(M1$.1))+E(0))
1390 ML$=CHR$(ASC(RIGHT$(M1$.1))+E(0))
1400 M1$=MF$+ML$
1410 PRINT LEFT$(DW$.18)LEFT$(LE$.14)"■■"M1$"■■"
1420 RETURN
1430 REM ****************************************************************
1440 REM         F6 PRESSED            SELECT 2ND MULTICOLOUR OF SPRITE
1450 REM ****************************************************************
1460 M2=PEEK(53286) AND 15
1470 M2=M2+1 IF M2>15 THEN M2=0
1480 POKE 53286.M2 OR 240
1490 M2$=MID$(STR$(M2).2) IF M2<10 THEN M2$=" "+M2$
1500 MF$=CHR$(ASC(LEFT$(M2$.1))+E(0))
1510 ML$=CHR$(ASC(RIGHT$(M2$.1))+E(0))
1520 M2$=MF$+ML$
1530 PRINT LEFT$(DW$.20)LEFT$(LE$.14)"■■"M2$"■■".
1540 RETURN
1550 REM ****************************************************************
1560 REM         F8 PRESSED            SELECT BACKGROUND COLOUR FOR SPRITE
1570 REM ****************************************************************
1580 BG=PEEK(53281) AND 15
1590 BG=BG+1 IF BG>15 THEN BG=0
1600 POKE 53281.BG OR 240
1610 BG$=MID$(STR$(BG).2) IF BG<10 THEN BG$=" "+BG$
1620 MF$=CHR$(ASC(LEFT$(BG$.1))+192)
1630 ML$=CHR$(ASC(RIGHT$(BG$.1))+192)
1640 BG$=MF$+ML$
1650 PRINT LEFT$(DW$.22)LEFT$(LE$.14)"■■"BG$"■■".
1660 RETURN
1670 REM ****************************************************************
1680 REM                               FILL OR BLANK BOX UNDER CURSOR
1690 REM ****************************************************************
1700 PRINT LEFT$(DW$.Y+3)LEFT$(RI$.X+1)"■■"CHR$(ASC(A$)+E(0))"■"
1710 S$(Y)=LEFT$(S$(Y).X)+CHR$(ASC(A$)+128)+MID$(S$(Y).X+2.24-X)
1720 IF LEN(S$(Y))=24 THEN S$(Y)=S$(Y)+CHR$(160)
1730 PM=INT(X/8) PK=832+Y*3+PM
1740 PN=X-8*PM
1750 IF A$=" " THEN POKE PK.PEEK(PK) AND (255-E(PN))
1760 IF A$="*" THEN POKE PK.PEEK(PK) OR E(PN)
1770 ON DI GOTO 1810.2060.1900.1990
1780 REM ****************************************************************
1790 REM                               MOVE CURSOR RIGHT
1800 REM ****************************************************************
1810 X=X+1
1820 IF X=24 THEN X=0 Y=Y+1
1830 IF Y=21 THEN Y=0
1840 POKE 53248.8*X+33
1850 POKE 53249.8*Y+66
1860 RETURN
1870 REM ****************************************************************
1880 REM                               MOVE CURSOR LEFT
1890 REM ****************************************************************
1900 X=X-1
1910 IF X=-1 THEN X=23 Y=Y-1
1920 IF Y=-1 THEN Y=20
1930 POKE 53248.8*X+33
1940 POKE 53249.8*Y+66
1950 RETURN
1960 REM ****************************************************************
1970 REM                               MOVE CURSOR UP
1980 REM ****************************************************************
1990 Y=Y-1
2000 IF Y=-1 THEN Y=20
2010 POKE 53249.8*Y+66
2020 RETURN
2030 REM ****************************************************************
2040 REM                               MOVE CURSOR DOWN
2050 REM ****************************************************************
2060 Y=Y+1
2070 IF Y=21 THEN Y=0
2080 POKE 53249.8*Y+66
2090 RETURN
2100 REM ****************************************************************
2110 REM                               MOVE CURSOR HOME AND CLEAR SPRITE
2120 REM ****************************************************************
2130 FOR I=832 TO 894 POKE I.0 NEXT
2140 FOR I=0 TO 20
2150 S$(I)=""
2160 NEXT
2170 IF RT THEN RETURN
2180 GOSUB 910
2190 REM ****************************************************************
2200 REM                               MOVE CURSOR HOME
2210 REM ****************************************************************
2220 X=0 Y=0 POKE 53248.33 POKE 53249.66 RETURN
2230 REM ****************************************************************
2240 REM     CTRL E PRESSED            END PROGRAM
2250 REM ****************************************************************
2260 PRINT "■■"CHR$(9).
2270 POKE 53269.0 POKE 53265.PEEK(53265) AND 191 POKE 788.49 POKE 792.71
2280 POKE 53280.14 POKE 53281.6 POKE 650.0 END
2290 REM ****************************************************************
2300 REM     RETURN PRESSED            MOVE CURSOR TO START NEXT LINE
2310 REM ****************************************************************
2320 X=0 Y=Y+1
2330 IF Y=21 THEN Y=0
2340 POKE 53248.33
2350 POKE 53249.8*Y+66
2360 RETURN
2370 REM ****************************************************************
2380 REM                               SETUP BORDER AND BACKGROUND COLOURS
2390 REM ****************************************************************
2400 POKE 788.52                      REM DISABLE RUN/STOP KEY
2410 POKE 792.193                     REM DISABLE RESTORE KEY
2420 POKE 53265.PEEK(53265) OR 64     REM SELECT EXTENDED COLOUR MODE
2430 POKE 53280.14 POKE 53281.6       REM SELECT BORDER AND BACKGROUND 0 COLOUR
2440 POKE 53282.7 POKE 53283.5        REM BACKGROUND COLOURS 1 & 2
2450 POKE 53284.12 PRINT CHR$(8)      REM BACKGROUND COLOUR 3  INHIBIT LOWERCASE
2460 POKE 650.PEEK(650) OR 128        REM REPEAT ON ALL KEYS
2470 FOR I=0 TO 7 E(I)=2↑(7-I) NEXT
2480 DW$="■■■■■■■■■■■■■■■■■■■■■■■■■" RI$="■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■"
2490 LE$="■■■■■■■■■■■■■■■■■■■■■■■■■■"
2500 DIM S$(20)
2510 RT=1 GOSUB 2130 RT=0 DI=1        REM SETUP SPRITE STRINGS
2520 FU$="■■■■■■■■ ■■■■■DLU"+CHR$(13) REM VALID FUNCTION KEYS
2530 REM ****************************************************************
2540 REM                               SETUP SCREEN DISPLAY
2550 REM ****************************************************************
2560 PRINT "■■         ■ ┐- ‹ (  ‾  ‾ ‾  ( ┌ -■        "
2570 PRINT "■ ■PRESS CTRL+E TO EXIT
2580 FOR I=1 TO 20 PRINT "■ ■■". NEXT
2590 PRINT "■■■■■■■■■■■■■■■■■■■■■■■■■".
2600 FOR I=1 TO 7 PRINT "■  ■■■". NEXT
2610 PRINT "■■■     ┬┬┬┬┬┬ ■ FILL■■■■■■■■   BOX ".
2620 PRINT "■■■■■■■■          ".
2630 PRINT "■■■■■■■■ SPACE ".
2640 PRINT "■■■■■■■■ CLEARS".
2650 PRINT "■■■■■■■■ BOX    ".
2660 PRINT "■■■■■■■■        ".
2670 A$="■■■■■■■■■■■■■■■■■■ "
2680 PRINT A$"F3 EXPAND XDIR".
2690 PRINT A$"   YES/■■┌■■     "
2700 PRINT A$"F5 EXPAND YDIR"
2710 PRINT A$"   YES/■■┌■■     ".
2720 PRINT A$"F7 MULTICOLOUR".
2730 PRINT A$"   YES/■■┌■■     ".
2740 PRINT A$"■F4■ SELECT 1ST ".
2750 PRINT A$"■■ "CHR$(242)"■■ MULTICOLOUR".
2760 PRINT A$"■F6■ SELECT 2ND ".
2770 PRINT A$"■■ "CHR$(243)"■■ MULTICOLOUR".
2780 PRINT A$"■F8■ SELECT      ".
2790 PRINT A$"■■ "CHR$(246)"■■ BACKGROUND ".
2800 PRINT A$"   COLOUR      ".
2810 PRINT "                                   ".
2820 PRINT "  CTRL/CBM KEYS CHANGE SPRITE COLOUR    ".
2830 PRINT "F1 PRINT SPRITE DATA  ■F2■ DISPLAY ON/OF ■■■F".
2840 PRINT LEFT$(DW$.25)"■■■■■■■■■■■ON/■■■—".
2850 GOSUB 910
2860 REM ****************************************************************
2870 REM                               SPRITE 1 IS THE ONE BEEING EDITED
2880 REM ****************************************************************
2890 POKE 53271.0 POKE 53277.0        REM SPRITE 1 NOT EXPANDED
2900 POKE 53276.0                     REM SPRITE 1 NOT MULTICOLOURED
2910 POKE 53288.1                     REM COLOUR SPRITE 1
2920 POKE 53285.2                     REM 1ST MULTICOLOUR
2930 POKE 53286.3                     REM 2ND MULTICOLOUR
2940 POKE 53250.239 POKE 53251.69     REM POSITION SPRITE 1
2950 POKE 2041.13                     REM ADDRESS SPRITE 1
2960 REM ****************************************************************
2970 REM                               SPRITE 0 IS 'CURSOR'
2980 REM ****************************************************************
2990 FOR I=704 TO 766 POKE I.0  NEXT
3000 FOR I=704 TO 725 STEP 3 POKE I.24 NEXT
3010 POKE 713.255 POKE 716.255
3020 POKE 2040.11                     REM ADDRESS SPRITE 0
3030 POKE 53287.6                     REM COLOUR SPRITE 0
3040 GOSUB 2220                       REM POSITION 'CURSOR'
3050 POKE 53269.3                     REM ENABLE SPRITES 0.1
3060 RETURN
```

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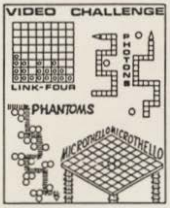

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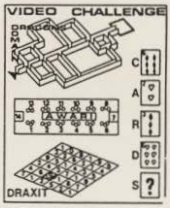

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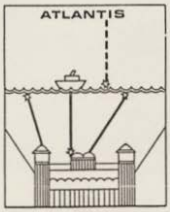

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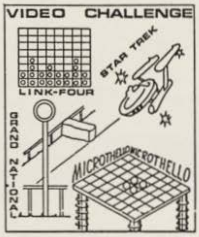

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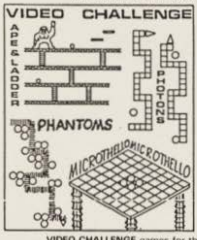

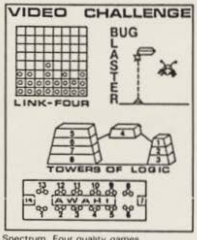

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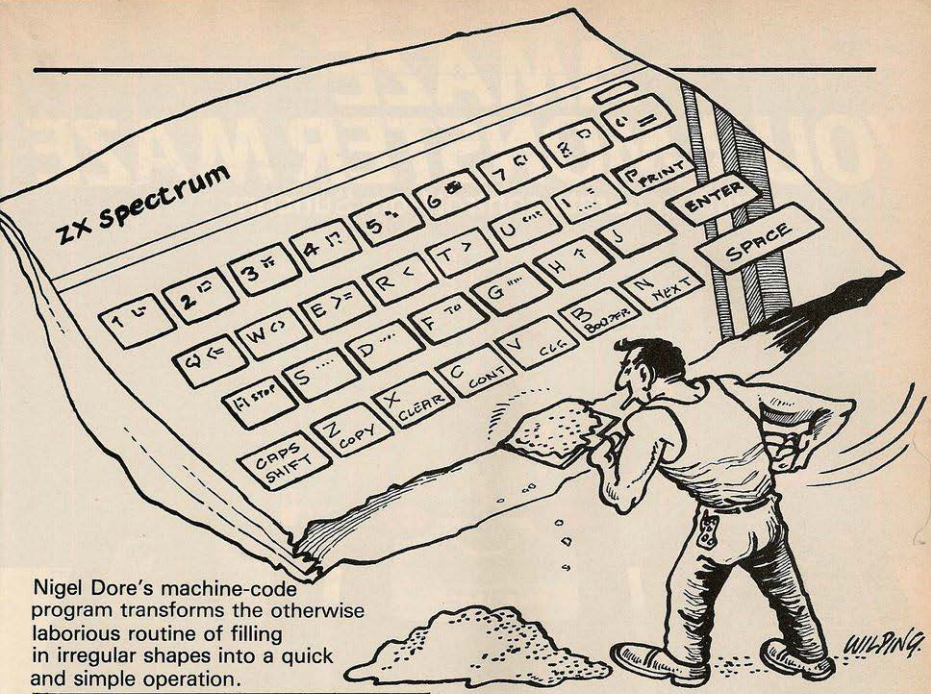
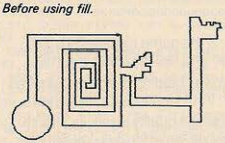


Nigel Dore's machine-code program transforms the otherwise laborious routine of filling in irregular shapes into a quick and simple operation.

SPECTRUM

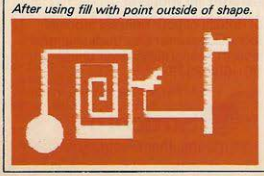
PAINT ROUTINE

Before using fill.



After using fill with point inside of shape.

After using fill with point outside of shape.



FILLING IN IRREGULAR shapes on the Spectrum can be a long and laborious process, which can be avoided by using this fill routine. The program, which is entirely in machine code, will fill any enclosed area simply given one point inside of it. The machine code is approximately 500 bytes long but requires about 6K for storage of a second screen. This use of memory is no problem on a 48K Spectrum but leaves the 16K with about 2.

The fill routine is entered into memory by using the program in figure 1. The length of the machine code means that mistakes are easily made and for that reason the program is extensively check-summed. So much so that the computer will tell you in which lines you have made your mistakes.

Having entered the program, Save it before you Run it, then Run it. If there are no detected mistakes the Basic program will now self-destruct. If mistakes are detected then correct them and rerun the program, repeating if necessary. Once the machine code has been entered it can be Saved with the command:

```
SAVE "FILL" CODE 32000,500
```

and loaded with the command:

```
CLEAR 25800: LOAD "FILL" CODE
```

(continued on page 121)

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Figure 1.

```
  1 REM Fill N.DORE
  2 REM
  3 REM Machine code at 32000
  4 REM
 10 DATA "F3C3AA7DFA6400C53EAF"
 20 DATA "9030043E01C1C9E5CDCE"
 30 DATA "22CDA222DE179C1C9C53E"
 40 DATA "AF9030043E00C1C94759"
 50 DATA "4B0600CB21CB10CB21CB"
 60 DATA "10CB21CB10CB21CB10CB"
 70 DATA "21CB107BCB3BCB3BCB3B"
 80 DATA "16002A047D1909CB23CB"
 90 DATA "23CB23C17993C601C947"
100 DATA "7ECB2710FC3B033E00C9"
110 DATA "3E01C9473E00371F10FD"
120 DATA "B677C9C5E5D5CD1C7DFE"
130 DATA "002004D1E1C1C9CD597D"
140 DATA "D1E1C1C9C5E5D5CD1C7D"
150 DATA "FE002004D1E1C1C9CD67"
160 DATA "7DD1E1C1C9C5F53EAF90"
170 DATA "3B05E5CDDF22E1F1C1C9"
180 DATA "2A047D0100163600230B"
190 DATA "7BB1FE0020F62A7D5CE5"
200 DATA "444D0CCD077DFE00200A"
210 DATA "CD9B7DCDB67D18F00000"
220 DATA "E1444D0DCD077DFE0020"
230 DATA "08CD9B7DCDB67D18F03E"
240 DATA "0032B15C2A047D0100AF"
250 DATA "7EFE00C4597E2379C60B"
260 DATA "FE00200105AF3EFFBB28"
270 DATA "7A18E9CD717DFE00CB04"
280 DATA "CD077DFE00CC6D7E050C"
290 DATA "CD077DFE00CC6D7E0D05"
300 DATA "CD077DFE00CC6D7E040D"
310 DATA "CD077DFE00CC6D7E0CC9"
320 DATA "E5112000237ECB7FE1C8"
330 DATA "E52B7ECB47E1CBE5197E"
340 DATA "FEFFE1C0E5A7ED527EFE"
350 DATA "FFE1C0D1C9CD367EC51E"
360 DATA "00D5CD077ED10C1C3E0B"
370 DATA "BB20F4C1C9CD717DFE01"
380 DATA "CBCDB67DCD9B7D3E0132"
390 DATA "815CC93A815CFE00CACC"
400 DATA "7E3E0032815C2A047D11"
410 DATA "FF151901FF007EFE00C4"
420 DATA "AD7E2B79D608FEFF2001"
430 DATA "044F3EB0BB281618E9CD"
440 DATA "367EC51E00D5CD077ED1"
450 DATA "0D1C3E0BBB20F4C1C93A"
460 DATA "815CFE00CACC7EC3E57D"
470 DATA "2A047D1100000100167E"
480 DATA "C50608CB273001131OF9"
490 DATA "C10B2378B1FE0020EC42"
500 DATA "4BFB9000000000000"
510 CLEAR 31999: LET a=32000: L
ET f=0: DIM a(50)
520 DATA 7377,8807,8313,5421,63
42,6660,6658,4971,6718,4836,4568
,9558,8293,9034,8595,9403,10142,
1364,7284,4029,5218,4938,7059,37
22,5694,5383,6622
530 DATA 4770,4772,4771,6723,77
52,7927,10343,7811,3899,8077,534
7,7981,3268,6525,6272,6705,7010,
7055,9062,1958,4321,6249,1180,77
33262
540 RESTORE 520: LET c=0: FOR i
=1 TO 50: READ a(i): LET c=c+a(i
)*i: NEXT i: READ v: IF c<>v THE
N PRINT "ERROR in lines 520 or 5
30": STOP
600 FOR i=10 TO 500 STEP 10: RE
STORE i: LET c=0: READ a$
610 FOR n=1 TO 19 STEP 2: LET l
=CODE a$(n+1): LET h=CODE a$(n)
620 LET v=(l-48-(l>57)*7)+(h-48
-(h>57)*7)*16: LET c=c+v*((n+1)/
2)
630 POKE a,v: LET a=a+1: NEXT n
: IF c<>a(i/10) THEN PRINT "ERRO
R in line ";i: LET f=1
640 NEXT i
650 IF f=0 THEN PRINT "All OK.B
YE": BEEP 1,0: POKE 23627,PEEK 2
3635: POKE 23628,PEEK 23636: CLE
AR 25800
660 PRINT ""Correct mistakes a
nd rerun."
```

(continued from page 119)

Now we can check the program, first we must reserve space for the second screen, thus type:

CLEAR 25800

Now we must draw an enclosed shape, for instance:

CIRCLE 100,100,50

Next we give the computer one point inside our shape with the plot command, thus enter:

PLOT 100,100

Then we instruct the computer to fill the area in with a USR call:

LET A=USR 32000

The circle should now be filled and as an added bonus A now contains the number of points plotted which is proportional to the area of the shape.

It should be noted that the program will fill any enclosed shape and not just circles. Great care must be taken that a gap is not left in the shape because a gap of just one pixel will allow the fill to spread to the whole screen. The normal ink, bright and flash commands are recognised only if there is no return to command mode between them and the USR call.

The program you now have in memory will work on either a 16K or 48K Spectrum. If you have a 48K Spectrum you will want to move it to a higher address. To do this, enter and run the relocator program in figure 2. The clear address now becomes 58600 and the USR address 64800. The code can be Saved with:

SAVE "FILL" CODE 64800,500

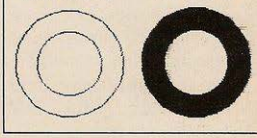
The algorithm used by the program is fairly simple to understand. Imagine two pieces of paper, the first represents the screen with the shape to be filled drawn on it. The second represents a corresponding blank screen stored in the computer's memory. The one point given to the computer is plotted onto the second sheet of paper.

The computer then starts at the top left of the second sheet and scans from left to right and down looking for a point. If it finds one, it then in turn checks each of the four points surrounding that point and plots each of them on both sheets of paper only if the point is not already set on the first sheet.

Once one scan is complete it is repeated but in the reverse direction and this continues until no more points can be plotted. Thus the overall effect is that the spreading of points is halted by a line on the first sheet.

Figure 3 is a set of routines for drawing various geometrical shapes which can then be filled. The routine which draws an ellipse is particularly interesting, the ellipse is in fact made up of 29 straight lines. This makes the program much faster than the more usual method of calculating each point individually from sines and cosines. ■

Before using fill. *After using fill.*



Shapes from figure 3 after being filled.

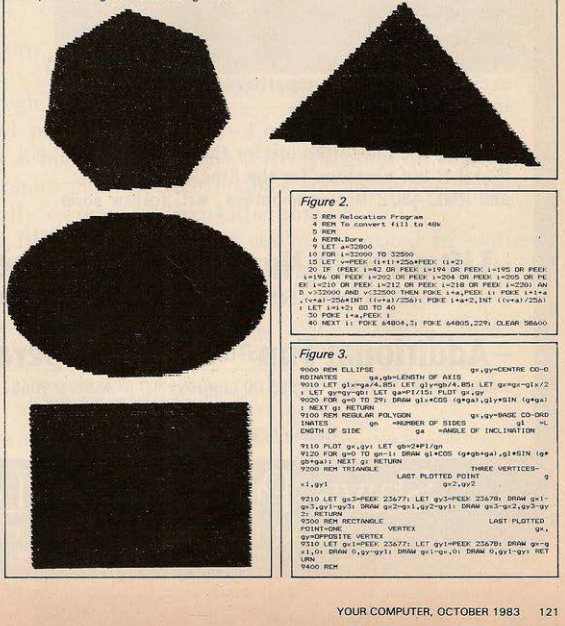


Figure 2.

```
  3 REM Relocation Program
  4 REM To convert fill to 48k
  5 REM
  6 REM N.Dore
  9 LET a=32800
 10 FOR i=32000 TO 32500
 15 LET v=PEEK (i+1)+256*PEEK (i+2)
 20 IF (PEEK i=42 OR PEEK i=194 OR PEEK i=195 OR PEEK
 i=196 OR PEEK i=202 OR PEEK i=204 OR PEEK i=205 OR PE
EK i=210 OR PEEK i=212 OR PEEK i=218 OR PEEK i=220) AN
D v>32000 AND v<32500 THEN POKE i+a,PEEK i: POKE i+1+a
,(v+a)-256*INT ((v+a)/256): POKE i+a+2,INT ((v+a)/256)
: LET i=i+2: GO TO 40
 30 POKE i+a,PEEK i
 40 NEXT i: POKE 64804,3: POKE 64805,229: CLEAR 58600
```

Figure 3.

```
9000 REM ELLIPSE                    gx,gy=CENTRE CO-O
RDINATES          ga,gb=LENGTH OF AXIS
9010 LET gl=ga/4.85: LET gl=gb/4.85: LET gx=gx-gl*2/2
: LET gy=gy-gb: LET ga=PI/15: PLOT gx,gy
9020 FOR g=0 TO 29: DRAW gl*COS (g*ga),gl*SIN (g*ga)
: NEXT g: RETURN
9100 REM REGULAR POLYGON            gx,gy=BASE CO-ORD
INATES          gn   =NUMBER OF SIDES          gl   =L
ENGTH OF SIDE          ga   =ANGLE OF INCLINATION

9110 PLOT gx,gy: LET gb=2*PI/gn
9120 FOR g=0 TO gn-1: DRAW gl*COS (g*gb+ga),gl*SIN (g*
gb+ga): NEXT g: RETURN
9200 REM TRIANGLE                   THREE VERTICES-
                    LAST PLOTTED POINT          g
x1,gy1                              gx2,gy2

9210 LET gx3=PEEK 23677: LET gy3=PEEK 23678: DRAW gx1-
gx3,gy1-gy3: DRAW gx2-gx1,gy2-gy1: DRAW gx3-gx2,gy3-gy
2: RETURN
9300 REM RECTANGLE                  LAST PLOTTED
POINT=ONE           VERTEX                      gx,
gy=OPPOSITE VERTEX
9310 LET gx1=PEEK 23677: LET gy1=PEEK 23678: DRAW gx-g
x1,0: DRAW 0,gy-gy1: DRAW gx1-gx,0: DRAW 0,gy1-gy: RET
URN
9400 REM
```

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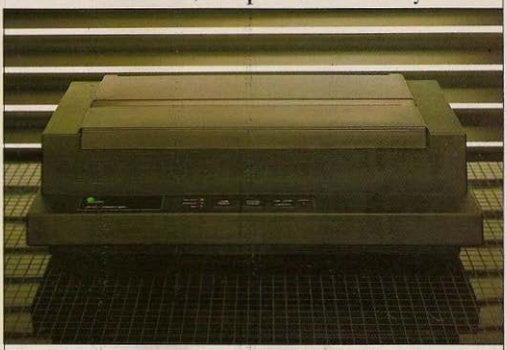

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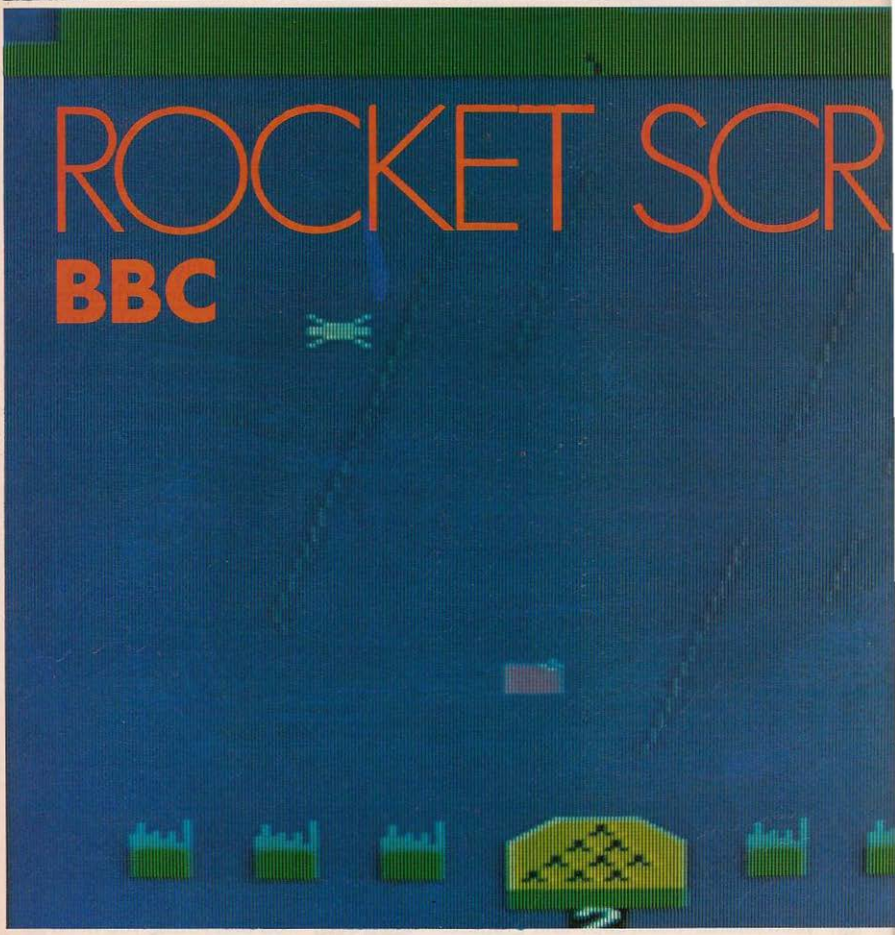

MISSILE COMMAND IS AN arcade-type game for the BBC Micro Model B or Model A with 32K. The program makes extensive use of the BBC's graphics and procedures to make a fast arcade favourite in BBC Basic and machine code.

After each of the three programs have been Chained, the computer will display the instructions. These show what the aim of the game is and the control keys. The game is based on the arcade game Missile Command, but has some minor changes. Instead of using a ball to move your sights, you must use four keys. Also, instead of three separate missile bases, you have one base in the centre which can be used three times. Base number is shown. It starts at three and works down. Six cities will be placed next to your base and you must defend these. Waves of enemy missiles appear from the top of the screen and work down towards your cities. You can destroy these missiles by laying clouds of explosions in their path. The missile will be destroyed if it enters a cloud.

Each missile base starts off with 10 missiles, which are fired by pressing the S key. To move your sights use the following keys:

W = up
X = down
A = left
D = right

Every so often, an enemy satellite will fly across the screen and can only be destroyed by a direct hit from one of your missiles. Bonus points are gained for destroying these as well as for completing a wave. After each wave you will be awarded points for any unused missiles or cities left untouched. You also gain points by shooting the missiles and your score is displayed in the top right hand corner of the screen. If all your cities are destroyed the game will end. A bonus city is awarded every 10,000 points. Also, each wave of enemy missiles is slightly faster until they reach an incredible speed and wipe out all your cities.

EEN

Destroy the enemy missiles before they reach your cities by laying down a barrage of firepower in their path. How long can you survive in John Wilson's arcade-type game for the BBC?

To fit this programming into the BBC's 32K requires some fiddling. In fact, the program must be split up into three parts, which have the following functions:

- Display title page and set page to &1100.
- Display control keys, define envelopes, define graphics characters and assemble machine code.
- The main game.

Unfortunately, the printer used has changed all occurrences of # in the program to £ in the listing. This is most noticeable in the machine code, so every time a £ appears in the listing, change it to #.

The program defines characters 192 to 223 as well as 224 to 255. Therefore, page must be set higher up in the memory to avoid corrupting the program. This is achieved in the first program, so that all subsequent programs will be loaded from location &1100 upwards.

The machine-code program is assembled from &D00 upwards and requires slightly over one page. Therefore, once the program has been Run, pressing the Break key will corrupt the machine code and you must reload it. Do not press the Break key until you have finished playing. The machine-code subroutine is used to print the explosions and should be quite easy to follow. The program requires data for the explosions to be stored in &A00 upwards. This tells the computer what size explosion to print and in which order. The program copes with seven different sizes of explosion so, sometimes, when two explosions overlap, a gap might appear between them. Therefore, try to avoid overlapping explosions when playing the game.

The main program should be quite easy to follow. To help with understanding how the program works, I will give a brief description of what the main parts do.

Program 1 description.

Lines	Use
50-111	Print up title page.
120	Define text screen.
130	Set page and Chain next program.

Program 2 description.

Lines	Use
30-120	Print up control keys.
130-160	Define envelopes.
170	Define text screen.
190-640	Define characters for explosions.
660	Define satellite
680	Define city.
700	Define arrow.
710	Define underline.
730-760	Set up pointers to explosions in &A00.
770-810	Make up explosions from characters and store in appropriate place in &A00.
820-1060	Assemble machine-code program.
1070-1110	Reset positions of explosions data.
1120	Chain next program.

Program 3 description.

Lines	Use
60	Trap errors.
90	Assemble explosions.
110	Make cursor invisible.
120	Start game.
130	Delete your sights.
140-170	Your movement.
180-190	Update score.
200	Plot your sights.
210	Fire missile.
220	Decrement timer for missile firing.
230	Main counter.
240	Move missiles, print explosions, move satellite.
250	Finished wave?
260	Bonus points.
270	Game finished?
280-380	Make up explosions.
390-460	Print up new screen.
470-530	Set up positions of cities.
540-590	Print missile base.
600-650	Put missiles inside base.

(continued on page 127)

Program 1.

```
 10 REM ....MISSILE COMMAND.... V3
 20 REM by J.R.Wilson on a BBC Model B
 30 REM
 40 MODE7
 50 FOR I=0 TO 24
 60 VDU 31,0,I,132,157,134
 70 NEXT
 80 VDU 31,5,5,129,141:PRINT"M I S S I L E   C O M M
A N D"
 90 VDU 31,5,6,129,141:PRINT"M I S S I L E   C O M M
A N D"
 100 VDU 31,5,18,130,141:PRINT"by"CHR$136" J.R.Wilson
"
 110 VDU 31,5,19,130,141:PRINT"by"CHR$136" J.R.Wilson
"
 120 VDU 28,10,15,38,10
 130 PAGE=&1100:CHAIN"M/PART2"
```

Program 1.

```
Program 2.
 10 REM ..MISSILE COMMAND PART2..
 20 REM by J.R.Wilson
 30 MODE7
 40PRINTCHR$129;CHR$157
 50FORI=0 TO 1
 60PRINTCHR$129;CHR$157;CHR$141;CHR$131;TAB(12)"MISS
ILE COMMAND"
 70NEXT
 80PRINTCHR$129;CHR$157;CHR$133;TAB(9)" BY J.Wils
on (1983)"
 90PRINTCHR$129;CHR$157;CHR$133;TAB(11)"(C) Wilsonsd
ft"
 100PRINT CHR$134"    KEYBOARD CONTROLS :-"
 110PRINT'TAB(14)"W    -    UP"' TAB(14)"X    -    DOWN"
 120PRINT'TAB(14)"A    -    LEFT"' TAB(14)"D    -    RIGH
T"' TAB(14)"S    -    FIRE"
 150ENVELOPE1,1,0,0,0,0,0,0,0,0,-3,126,126
 160ENVELOPE2,1,0,0,0,0,0,0,30,0,0,-1,126,126
 150ENVELOPE3,128,0,0,0,0,0,0,70,-80,0,1,126,0
 160ENVELOPE 4,5,1,1,7,1,1,5,126,0,0,-1,126,50
 170 VDU 28,10,23,30,18
 180 Z=&D00
 190 REM P1
 200 VDU 23,192,0,0,0,0,24,24,0,0
 210 REM P2
 220 VDU 23,193,0,24,60,126,126,60,24,0
 230 REM P3
 240 VDU 23,194,126,255,255,255,255,255,255,126
 250 REM P4
 260 VDU 23,195,0,0,0,0,0,0,0,0
 270 VDU 23,196,0,0,0,0,0,0,60,126
 280 VDU 23,197,0,0,0,0,0,0,0,0
 290 VDU 23,198,0,1,3,3,3,3,1,0
 300 VDU 23,199,255,255,255,255,255,255,255,255
 310 VDU 23,200,0,128,192,192,192,192,128,0
 320 VDU 23,201,0,0,0,0,0,0,0,0
 330 VDU 23,202,126,60,0,0,0,0,0,0
 340 VDU 23,203,0,0,0,0,0,0,0,0
 350 REM P5
 360 VDU 23,204,0,0,0,0,0,0,1,7,7
 370 VDU 23,205,0,0,0,0,126,255,255,255
 380 VDU 23,206,0,0,0,0,0,128,224,224
 390 VDU 23,207,15,15,31,31,31,31,31,31
 400 VDU 23,208,255,255,255,255,255,255,255,255
 410 VDU 23,209,240,240,240,240,248,248,248,248
 420 VDU 23,210,15,15,7,7,1,0,0,0
 430 VDU 23,211,255,255,255,255,255,255,126,0,0
 440 VDU 23,212,240,240,224,224,128,0,0,0
 450 REM P6
 460 VDU 23,213,0,0,1,3,3,7,15,31
 470 VDU 23,214,0,0,255,255,255,255,255,255
 480 VDU 23,215,0,0,128,192,192,224,240,248
 490 VDU 23,216,31,63,63,63,63,63,63,31
 500 VDU 23,217,255,255,255,255,255,255,255,255
 510 VDU 23,218,248,252,252,252,252,252,252,248
 520 VDU 23,219,31,15,7,3,3,1,0,0
 530 VDU 23,220,255,255,255,255,255,255,255,0
 540 VDU 23,221,248,240,240,224,192,192,128,0
 550 REM P7
 560 VDU 23,222,3,7,15,31,63,127,255,255
 570 VDU 23,223,255,255,255,255,255,255,255,255
 580 VDU 23,224,192,224,240,248,252,254,255,255
 590 VDU 23,225,255,255,255,255,255,255,255,255
 600 VDU 23,226,255,255,255,255,255,255,255,255
 610 VDU 23,227,255,255,255,255,255,255,255,255
 620 VDU 23,228,255,255,127,63,31,15,7,3
 630 VDU 23,229,255,255,255,255,255,255,255,255
 640 VDU 23,230,255,255,254,252,248,240,224,192
 650 REM SAT
 660 VDU 23,232,129,66,60,255,255,60,66,129
 670 REM CITY
 680 VDU 23,233,0,1,65,65,85,245,253,255
 690 REM ARROW
 700 VDU 23,234,0,60,60,60,60,255,126,60,24,0
 710 REM UNDERLINE
 720 VDU 23,235,255,255,255,255,0,0,0,0
 730 X%=&A00:Y%=X%+10:T%=Y%+10
 740 XL%=T%+10:YR%=XL%+10:YL%=YR%+10
 750 YH%=YL%+10:XDL%=YH%+10:YDL%=XDL%+10
 760 FT%=YDL%+10:IDES=FT%+10:YHS=IDES+10
 770 C#=CHR$0+CHR$0+CHR$0+CHR$0
 780 T4%=YH%+10:F1%=C#+CHR$195+CHR$195+CHR$197+C#+CHR$
199+CHR$199+CHR$200+C#+CHR$201+CHR$202+CHR$203
 790 T5%=T4%+20:F2%=C#+CHR$204+CHR$205+CHR$206+C#+CHR$2
07+CHR$208+CHR$209+C#+CHR$210+CHR$211+CHR$212
 800 T6%=T5%+20:F3%=C#+CHR$213+CHR$214+CHR$215+C#+CHR$2
16+CHR$217+CHR$218+C#+CHR$219+CHR$220+CHR$221
 810 T7%=T6%+20:F4%=C#+CHR$222+CHR$223+CHR$224+C#+CHR$2
25+CHR$226+CHR$227+C#+CHR$228+CHR$229+CHR$230
 820 FOR I=0 TO 3 STEP 2
 830 P%=Z%
 840 OPT I
 850 .explosions LDAEQ3:STA&70
 860 .loop LDX &70:LDA T%,X:CMP#0:BEQ back:LDA X%,X:S
TA &71:LDA Y%,X:STA &72:LDA T%,X:STA &73
 870 LDA&32:DEC &72:DEC &71:JSR printat:JSR &FFEE:JSR
&FFEE:INC &72:JSR printat:JSR &FFEE:JSR &FFEE
 880 INC &72:JSR printat:JSR &FFEE:JSR&FFEE:DEC &72:D
EC &72:INC T%,X:INC &73:LDA &73
 890 CMPC13:BNE notend:LDAEQ3:STA T%,X:.back LDA&70:IN
C&70:CMPC9:BNE loop:RTS
 900 .notend CMPC1:BNE not1:.but13 LDAC192:INC&71:INC
&72:JSR printat:JMP back
 910 .not1 CMPC13:BEQ but13:CMPC2:BNE not2
 920 .but12 INC&71:INC&72:LDAC193:JSR printat:JMP back
 930 .not2 CMPC12:BEQ but12:CMPC3:BNE not3
 940 .but11 INC&71:INC&72:LDAC194:JSR printat:JMP bac
k
 950 .not3 CMPC11:BEQ but11:CMPC4:BNE not4
 960 .but10 LDX &70:LDA T%,X MOD 256:LDY &71: DIV 256:JSR pri
ntword:JMP back
 970 .not4 CMPC10:BEQ but10:CMPC5:BNE not5
 980 .but9 LDX&70:LDA T%,X MOD 256:LDY &71DIV 256:JSR print
word:JMP back
 990 .not5 CMPC9:BEQ but9:CMPC6:BNE not6
 1000 .but8 LDX&70:LDA T%,X MOD 256:LDY&70:LDY 256:JSR printw
ord:JMP back
 1010 .not6 CMPC8:BEQ but8:LDXC77: MOD 256:LDYC77:DIV2
56:JSR printword:JMP back
 1020 .printat PHA:LDAC3:JSR&FFEE:LDA&71:JSR&FFEE:LDA
&72:JSR&FFEE:PLA:JSR&FFEE:RTS
 1030 .printword STX&80:STY&81:LDAC0:JSR printat:LDXC0
:.goback LDA(&80,X)
 1040 CMPC13:BNE noten:RTS:.noten JSR &FFEE:LDA &80:IN
C&80:CMPC255:BNEgoback:INC&81:JMP goback
 1050 ]
 1060 NEXT
 1070 FOR I=0 TO 9
 1080 X%?I=0
 1090 Y%?I=0
 1100 T%?I=0
 1110 NEXT
 1120 CHAIN "M/PART3"
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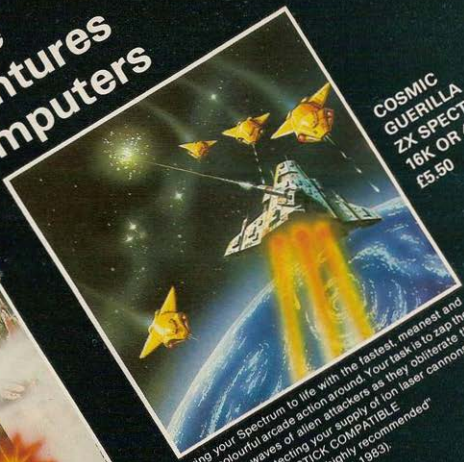

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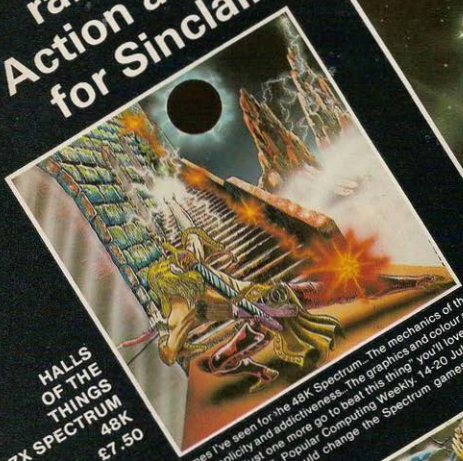

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(continued from page 125)

670-690	Print arrows.
700-790	Print instructions.
800-850	Reset information about your explosions.
860-880	Reset main variables.
900-930	Delete instructions.
940-960	Define missile colours.
970-1000	Add bottom to cities.
1020-1050	Plot position of bullet in base.
1060-1080	Call machine code to do explosions.
1130-1230	Print up a new missile base.
1240-1330	Fire missile.
1340-1410	Set position of explosion.
1420-1440	Delete missile.
1450	Hit satelite?
1470-1610	Next wave of missiles.
1620-1730	Set up positions of enemy missiles.
1740	Position of satellite.
1760-1820	Add a new enemy missile to screen.
1830-2000	Move enemy missiles.
1930-1960	Have the missiles hit anything?
2060-2250	Hit a city.
2260-2370	Hit missile base.
2380-2450	Hit explosion.
2460-2550	Delete missile.
2560-2550	Gain bonus prints.
2640-2850	For any unused missiles.
2870-2970	For cities.
3020-3050	Reprint missile base.
3080-3110	Reprint cities or craters.
3120	Game finished.
3130-3210	Reset variables.
3220	Gain bonus city.
3230-3350	Add bonus cities if any room on screen.
3360-3390	Displays errors.
3400-3500	Game has finished.
3510-3610	Move satellite.

As the program is so large, it will only work on a 32K computer without a disc. If your computer has a disc interface then I recommend you reset page to &E00 and Load from cassette.

With the information given above and the use of appropriately named procedures, and a few Rems, the program should be easily modified, or converted to another computer.

One final note, when typing in program 2, I recommend you to set page to &1100 by

PAGE=&1100

otherwise the program will be corrupted if Run.

Program 3.

```
10REM
20REM MISSILE COMMAND PART3
30REM by J.R.Wilson Feb 1982
40REM for a BBC Model B in 32K
50REM
60ON ERROR GOTO 3360
70S5=0:Q5=4:Z5=&500:HE5=0
80DIM ZX(6),ZX(6),MXX(10),MYX(10),MMX(10),MMX(10),
MMX5(10),MX5(10),MY5(10)
90PROCAS
100MODE4
110VDU 23;8202;0;0;0;
120PROCSETUP:PROCMAVE
130GOSUB,4:PLOT4,YX5-8,YX5:PLOT4,YX5+8,YX5:PLOT4,
YX5,YY5-4:PLOT4,YX5,YY5+4
140IF INKEY(-67) AND YY5:200 THEN YY5=YY5-16
150IF INKEY(-67) AND YY5:1000 THEN YY5=YY5+16
160IF INKEY(-66) AND YX5:96 THEN YX5=YX5-32
170IF INKEY(-51) AND YX5:1200 THEN YX5=YX5+32
180COLOUR 7:COLOUR132
190PRINT TAB(10,2);$Z
200GOSUB,7:PLOT4,YX5-8,YY5:PLOT4,YX5+8,YY5:PLOT4,
YX5,YY5-4:PLOT4,YX5,YY5+4
210IF INKEY(-82) AND SHE0=0 THEN PROCFIRE
220IF SHO%:0 THEN SHO%=SHO%+1:IF SHO%=5 THEN SHO%=0
230LX%=LX+1
240IF LX MOD (15-WX%)=0 THEN PROCEXP:PROCMOVE ELSE I
F LX MOD 5=0 THEN PROCSHIP
250IF HX=-DX THEN ZX=ZX GOTO 130
260PROCBONUS
270IF SCX=-1 THEN 120 ELSE PROCMAVE:GOTO130
280REM PROCAS
290X%=&400:Y%=X%:I0%=TY%+10
300LX%=TX%:I0%=X%:L%=10:L%=X%+10
310Y%0=Y%:X%=X%+10:YD%=YD%+8:YL%=10
320FORI=0TO7:PRINTTAB(I,0)CHR$(ASC"A"+RND(26))
330CX=RND(8)+CHR$(ASC"A"+RND(26))
340T4$=YD%+10:T4$=CHR$195+CHR$196+CHR$197+CH$+CHR$1
98+CHR$199+CHR$200+CHR$201+CHR$202+CHR$203
350T5$=T4$:T5$=CHR$204+CHR$205+CHR$206+CH$+CHR$20
7+CHR$208+CHR$209+CH$+CHR$210+CHR$211+CHR$212
360T6$=T5$:T6$=CHR$213+CHR$214+CHR$215+CH$+CHR$21
6+CHR$217+CHR$218+CH$+CHR$219+CHR$220+CHR$221
370T7$=T6$:T7$=CHR$222+CHR$223+CHR$224+CH$+CHR$22
5+CHR$226+CHR$227+CH$+CHR$228+CHR$229+CHR$230
380ENDPROC
390REM PROCSETUP
400VDU20
410COLOUR 132:CLS
420PRINT "HIGH"TAB(10)"SCORE";HS$;TAB(30);$X
430S8=0
440BGOL0,2:VDU5
450PRINT TAB(0,29);STRING$(40,CHR$199);
460VDU4:COLOUR 4
470ENDPROC:RETURN
480FOR I=1 TO 4
490Z$(I)=1
500READ X$,Y$
510PRINT TAB(X$(I),28);CHR$253;
520NEXT
530DATA 2,4,6,12,14,16
540COLOUR 3
550PRINT TAB(8,28);CHR$222CHR$223CHR$224;TAB(8,29);C
HR$225CHR$226CHR$227;
560COLOUR 130
570PRINT TAB(8,30);CHR$235CHR$235CHR$235;
580COLOUR128:COLOUR7:PRINTTAB(9,31);"3";
590COLOUR 132:GOSUB,0
600FOR I=1 TO 10
610READ MX,MY
620MX(I)=MX-550
630MY(I)=MY-50
640PROCBULLET(I)
650NEXT
660COLOUR 10
670FOR I=1 TO 6
680PRINT TAB(ZX(I),25);CHR$234;
690NEXT
700COLOUR 13
710PRINT TAB(1,5)"DEFEND YOUR CITYS""" FROM THE MI
SSILES.""" CONTROLS ARE:"
720COLOUR 12
730PRINT "  W""""  A  D""""
X"
740COLOUR 11
750PRINT "  S TO FIRE."
760COLOUR 14
770PRINT " SPACE BAR TO START."
780COLOUR 8
790PRINT TAB(2,23);"YOUR  CITYS."
800FOR I=0 TO 9
810T(I)=I+0
820T(I)=I+0
830T(I)=I+0
840T(I)=I+0
850NEXT
860YX%=500:YYX=300
870W=0
880SH%(0)=RND(8)+RND(8):HE%=0:SC%=0:BD%=0
890REPEAT UNTIL EET%=
900PRINT TAB(10,2);"  ";
910FOR I=5 TO 27
920PRINT TAB(0,I);SPC(20);
930NEXT
940FOR I=8 TO 15
950VDU 19,I,1,0,0,0
960NEXT
970VDU 19,14,2,0,0,0
980FOR I%=1 TO 4
990COLOUR4:PRINTTAB(CX%(I%),29);CHR$225;
1000NEXT
1010ENDPROC
1020DEF PROCBULLET(Z)
1030PLOT 4Y,MX(Z),MY(Z):PLOT4,MX(Z)+16,MY(Z)
PLOT4,MX(Z)+8,MY(Z)+4:PLOT4,MX(Z)+8,MY(Z)+8
ENDPROC
1040DATA 50,40,35,44,60,48,0,28,50,28,92,28
1050DATA -16,10,35,10,40,10,118,10
1060DEF PROCEXP
1070COLOUR 5:COLOUR 132
1080CALL E%
1090IF SHO:>0 THEN ENDPROC
1100IF BX=1 THEN ENDPROC
1110IF BD%=0 THEN 1170
1120IF TIME:BD% THEN ENDPROC
1130COLOUR 1:COLOUR 132
1140PRINT TAB(0,28);CHR$222CHR$223CHR$224;TAB(0,29);C
HR$225CHR$226CHR$227;
1150COLOUR 7
1160PRINT TAB(0,30);CHR$235CHR$235CHR$235;
1170BYC=10:BD%=1
1180COLOUR128:COLOUR7:PRINTTAB(9,31);BD;
1190ENDPROC
1200IF BD% 10
1210PROCBULLET(I)
1220NEXT
1230GOSUB 3,17,200,5:ENDPROC
1240DEF PROCFIRE
1250IF SHE0=0 THEN ENDPROC
1260BX=1
1270GOCL 4,0
1280VDU 4:10,130
1290RAM YX5,YY5
1300GOSUB 0,1,4,10
1310GOCL0,3
1320PROCBULLET(SHE%)
1330SHE=SHE-1
1340L=-1
1350FOR I%=0 TO 9
1360IF ?T(I%)=0 THEN FL=I%
1370NEXT
1380IF FL=-1 THEN 1420
1390T(FL)=1
1400T(4%+FL)=YX5 DIV 64
1410T(8%+FL)=YY5 DIV 32
1420GOCL4,0
1430MOVE 10,130
1440RAM YX5,YY5
1450IF BX%=YX5 DIV 64 AND SYX%1-(YY5 DIV 32) THEN SO
UND &211,2,100,5:SOUND &212,2,90,5:SOUND &211,2,110,5:
SOUND&1,0,0,0:SEX%=20:SX=SX+WX%:SCX=SCX+WX%:W=0
1460ENDPROC
1470DEF PROCMAVE
1480LX%=0:CEX=0:HX=15:WX=WX+1:WX%=WX
1490IF WX%>11 THEN WX%=1
1500IF WX%15 THEN WX%=1
1510COLOUR1:COLOUR132
1520PRINT TAB(5,10);"WAVE = ";WX
1530GOSUB &202,4,100,5
1540GOSUB &202,4,101,5
1550GOSUB &202,4,99,5
1560FOR I=0 TO 9
1570GOSUB &215,0,0,0
1580GOSUB &215,0,0,0
1590GOSUB &211,0,0,0
1600REPEAT:TIME=0:REPEAT UNTIL TIME:MX
1610PRINT TAB(5,10);SPC(10)
1620FOR I=0 TO 6X
1630X%=RND(4)
1640IF CS(X%)=0 AND RND(5)<5 THEN 1650
1650MX%=RND(1000)+100
1660X%=RND(300)+600
1670GOCL 0,9
1680PLOT 4M,MX,MX
1690MMX(I)=MX
1700MMX(I)=MX
1710MMX5(I)=MX
1720X5(I)=X%:MY(I)=MX
1730NEXT
1740SX%=RND(8)+RND(20)+5
1750ENDPROC
1760DEF PROCNEW
1770X%=RND(4)
1780IF CS(X%)=0 AND RND(5)<5 THEN 1770
1790X%=RND(300)+600
1800MX%=RND(300)+600
1810MMX(I%)=MX:MMX5(I%)=MX:MX5(I%)=MX:MY(I%)=MX:MY5(
I%)=MX
1820ENDPROC
1830DEF PROCMOVE
1840FL=0
1850FOR I%=0 TO 6X
1860IF MMX(I%)=0 AND MX:0 THEN PROCNEW:GOTO 1980
1870IF MMX(I%)=0 THEN 1980
1880FL=1
1890MOVE MMX(I%),MMX(I%)
1900IF (MX(I%)<X5(MMX(I%))+64+32 THEN MMX(I%)=MMX(
I%)-8 ELSE MMX(I%)=MMX(I%)+8
1910MX(I%)=MMX(I%):MX:16
1920X%=POINT(MMX(I%),MMX(I%))
1930IF X%=1 OR X%=2 THEN 2010
1940IF X%=4 OR X%=14 THEN 2060
1950IF X%=8 THEN 2260
1960IF X%=5 THEN 2380
1970GOSUB,8:DRAW MMX(I%),MMX(I%)
1980NEXT
1990IF HSC=0 AND FL2=0 THEN MX=-DX
2000ENDPROC
2010PROCBOMBLETE(I%)
2020MMX(I%)=0
2030X%=MX-I
2040GOSUB 0,2,5,3
2050GOTO 1980
2060REM HIT CITY
2070PROCDELETE(I%)
2080X%=MX DIV 64
2090FL=-1
2100FOR I=1 TO 6
2110IF X%=CX%(I) THEN FL=I
2120NEXT
2130IF FL=-1 THEN ENDPROC
2140CX%(FL)=0
2150COLOUR 3:COLOUR132
2160PRINT TAB(CX%(FL)-1,28);"\!/"
2170COLOUR 1:COLOUR 132
2180PRINT TAB(CX%(FL),29);CHR$235;
2190GOSUB32
2200GOSUB 0,2,6,10
2210GOCL 0,3
2220MMX(I%)=0
2230FOR I=0 TO 100:NEXT
2240PRINT TAB(CX%(FL)-1,28);"  ";
2250GOTO 1980
2260REM HIT MISSILE BASE
2270GOSUB 0,1,6,10
2280X%=MX-I
2290PROCDELETE(I%)
2300MMX(I%)=0
2310REM
2320COLOUR132
2330COLOUR4:PRINTTAB(8,28);CHR$222CHR$223CHR$224;
2340COLOUR130:PRINTTAB(8,29);CHR$228CHR$229CHR$230;
2350REM
2360COLOUR4:PRINT TAB(8,30);CHR$235CHR$235CHR$235;
2370BD%=TIME+500
2380GOTO 1980
2390REM HIT EXPLOSION
2390X%=MX-I
2400GOSUB 0,2,5,5
2410X%=SX+WX%
2420SCX=SCX+WX%
2430PROCDELETE(I%)
2440MMX(I%)=0
2450GOTO 1980
2460DEF PROCDELETE(Z)
2470GOCL0,4
2480X%=BX%(Z):MX=DY%(Z)
2490REPEAT
2500PONE MX,MX
2510IF MX:XX%(MMX(Z))+64+32 THEN MX=MX-8 ELSE MX=MY
X+8
2520NEXT:MX=MX-16
2530GOSUB MX,MX
2540UNTIL MX<MMX(Z)+16+WX
2550ENDPROC
2560DEF PROCBONUS
2570FOR I=1 TO 27:PRINT TAB(0,I);SPC(20);:NEXT
2580GOCL 0,7
2590COLOUR 5
2600PRINT TAB(1,10);"SHOTS="
2610PRINT TAB(1,15);"CITYS="
2620MX%=500:MY%=72
2630IF BX<=1 THEN 2730
2640FOR I=1 TO 10*BX
2650GOSUB 2,5,200,1
2660PLOT 4Y,MX,MX:PLOT 4Y,MX+16,MX:PLOT4Y,MX+8,MX+4:P
LOT4Y,MX+8,MX+8
2670GOCL 0,3
2680FOR I=1 TO 10
2690PRINT TAB(10,2);BX
2700GOSUB 2,5,200,1
2710NEXT
2720IF BX=0 THEN 2860
2730FOR I=1 TO 3X%
2740GOSUB 2,5,200,1
2750GOCL 0,7
2760PLOT 4Y,MX,MX:PLOT 4Y,MX+16,MX:PLOT4Y,MX+8,MX+4:P
LOT4Y,MX+8,MX+8
2770GOCL 0,3
2780PROCBULLET(I)
2790GOSUB&NE
2810SCX=SCX+WX
2820PRINT TAB(10,2);BX
2830FOR J=0 TO 300:NEXT
2840MX=MX+32
2850NEXT
2860GOCL 0
2870FOR I=1 TO 6
2880IF CX(I)=0 THEN 2970
2890GOSUB 2,3,100,2
2900PRINT TAB(CX%(I),28);" ";
2910PRINT TAB(MX,15);CHR$233;
2920MX=MX-2
2930X%=SX+WX*20
2940SCX=SCX+WX*20
2950PRINT TAB(10,2);X%
2960FOR J=0 TO 300:NEXT
2970NEXT
2980FOR I=1 TO 500:NEXT
2990COLOUR132
3000FOR I=5 TO 28:PRINT TAB(0,I);SPC(20);:NEXT
3010COLOUR132
3020GOCL0,2:VDU5:PRINT TAB(0,29);STRING$(40,CHR$199);
:VDU4
3030COLOUR 3:PRINT TAB(0,28);CHR$222CHR$223CHR$224;TA
B(0,29);CHR$225CHR$226CHR$227;
3040COLOUR130:PRINT TAB(8,30);CHR$235CHR$235CHR$235;
3050 COLOUR128:COLOUR7:PRINTTAB(9,31);"3";
3060FL=0
3070COLOUR132
3080FOR I=1 TO 6
3090COLOUR132
3100IF CX(I)=0 THEN COLOUR4:PRINT TAB(CX%(I),28);CHR$
233;FL=1:COLOUR14:PRINT TAB(CX%(I),29);CHR$235; ELSE
COLOUR130:COLOUR4:PRINTTAB(CX%(I),29);CHR$235;
3110NEXT
3120IF FL=0 THEN 3400
3130BX=3
3140BX=10
3150GOCL0,0
3160FOR I=1 TO 10
3170PROCBULLET(I)
3180NEXT
3190FOR I=0 TO 9
3200T(I%)=0
3210NEXT
3220IF SCX:10000 THEN SCX=SCX-10000:BC%=BC%+1:GOTO 32
20
3230FL=-1
3240FOR I=1 TO 6
3250IF CX(I)=0 THEN FL=I
3260NEXT
3270IFFL=-1 OR BC%=0 THEN ENDPROC
3280GOSUB 3,2,100,10
3290BC%=BC%-1
3300CX(FL)=1
3310COLOUR4:COLOUR132
3320PRINT TAB(CX%(FL),28);CHR$233;
3330COLOUR14
3340PRINT TAB(CX%(FL),29);CHR$225;
3350GOGTO 3230
3360IF EZE%= THEN 120
3370REPORT
3380PRINT " in line ";ERL
3390END
3400GOSUB 0,1,6,20
3410COLOUR132:COLOUR4
3420PRINT TAB(3,7);"SCORE = ";$X
3430PRINT TAB(3,10);"HIGH SCORE";HS$
3440BD%=TIME+200:REPEAT UNTIL TIME:BD%
3450COLOUR14:3
3460IF HS:HSX THEN VDU20:COLOUR14:COLOUR13:HSX=$X
3470PRINT TAB(3,13);"HIGH SCORE";HS$
3480BD%=TIME+1000:REPEAT UNTIL TIME:BD%
3490GOTO-3
3500ENDPROC
3510DEF PROCSHIP
3520COX=COX+1
3530IF COX:100 THEN SXX=0:COX=0:ENDPROC
3540IF SXX=20 THEN ENDPROC
3550GOSUB &13,4,100,10
3560COLOUR132
3570PRINT TAB(SXX,SY%);" ";
3580SXX=SXX+1
3590IF SXX=20 THEN SY%=RND(20)+5:SOUND&13,0,0,0:ENDPR
OC
3600PRINT TAB(SXX,SY%);CHR$232;
3610ENDPROC
```

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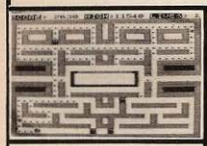

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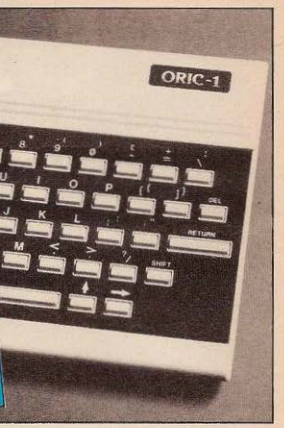
```
0 X=300:F=1:A=49060:LORES0:IFK<3.4THENGOSUB50ELSEGOSUB100
10 WAITX:FORC=2TO200:A$=KEY$:F=F+(A$=CHR$(B))-(A$=CHR$(9)):F=F-4*(F
=0)+4*(F=5)
20 A=A+(F=4)-(F=2)+40*(F=1)-40*(F=3):V=PEEK(A):POKEA,17
30 IFV=16THENNEXT:PING:U=U+1:Z=0:K=K-((K<>3.4)/5):GOTO0
40 Z=C:EXPLODE:L=L+1:IFL=3THENPRINT"YOURE DEAD WITH A SCORE OF-";U*
10+INT(C/20):END
45 GOTO0
50 FORC=1TOU:POKE 48080+INT(RND(1)*1039),20:NEXTC:FORC=0TO38:PLOTC,
0,21
60 PLOTC,26,21:NEXTC:FORC=1TO25:PLOTO,C,21:PLOT38,C,21:NEXTC
70 FORC=2TO36STEP5-K:FORD=2TO24STEP5-K:PLOTC,D,18:NEXTD,C
80 PLOT13,0,16:PLOT14,0,"GRIDRUNNER ":RETURN
100 FORC=0TO38:PLOTC,0,22:PLOTC,26,22:NEXTC:FORC=1TO25:PLOTO,C,22:P
LOT38,C,22
110 NEXTC:FORD=0TO10STEP2:FORC=2+DTO36-D:PLOTC,2+D,23:PLOTC,24-D,23
:PLOTC,24,16
120 NEXTC:FORG=2+DTO24-D:PLOT2+D,G,23:PLOT36-D,G,23:NEXTG,D:PLOT11,
0,16
130 PLOT12,0,"OPEN GATES ":WAIT300:REPEAT:A$=KEY$:F=F+(A$=CHR$(B))-
(A$=CHR$(9))
140 F=F-4*(F=0)+4*(F=5):A=A+(F=4)-(F=2)+40*(F=1)-40*(F=3):V=PEEK(A)
:POKEA,17
150 IFA=48099THENFORC=4TO20STEP4:PLOT19,C,16:NEXTC
160 IFA=48539THEN200
170 UNTILV<>16:EXPLODE:L=L+1:IFL<>3THEN0
180 PRINT"YOU'RE DEAD WITH A SCORE OF-";(U-1)*10:END
200 CLS:FORC=0TO7:PAPERC:WAIT25:NEXTC
210 PRINT"SO YOU THOUGHT YOU WERE GOOD DID YOU?"
220 PRINT"GUESS AGAIN!<*><*><*>THIS TIME ITS    EVEN HARDER!":K=0:W
AITX:GOTO0
```



MATRIX RUN

Boolean algebra puts the zip in this fast Oric game by Russ Whitehead.

MATRIX RUN'S speed is achieved primarily by reducing the repeated part of the program to just three lines, and is made possible with the use of Boolean algebra and by Poking rather than plotting characters on to the screen.

It was developed after having played many ultra-slow games and being bored by the efforts of fellow computer maniacs at school and in the town in which I live. I was determined to find a game which was interesting, colourful and fast moving. It was an abortive attempt at a *Tron* light cycle program which eventually allowed me to program Matrix Run.

Even then my problems were not resolved. The initial program was so slow that I could have eaten my lunch while playing the game and still not lost a life. I finally achieved success after discovering the intricacies of Boolean algebra, and with the help of an April 1983 *Your Computer* article on Spectrum fast graphics which gave me some hints on quick plotting.

The object of the game is to survive for 200 cycles or movements of the runner, without crashing into a wall, a green obstacle or a blue obstacle. Green obstacles are placed in strict rows and columns and the blue obstacles are placed randomly. On completion of 200 cycles there is a ping and a new screen appears. This has more green and blue obstacles to avoid. Each new screen becomes increasingly harder until the 17th when a new type of maze structure appears.

This screen consists of concentric squares and the aim is to reach the centre of the maze. However, as you shall see if you are lucky enough to get this far there are no openings in the squares. To create these you must pass directly beneath the Open Gates sign.

Variables.

A	Position of the runner as Poked on to the screen.
C,D,G	Variables used in the For-Next loops, most common is C.
F	The direction of the runner, if F is 1 then the direction is up if F is 2 then the direction is right if F is 3 then the direction is down if F is 4 then the direction is left
K	The difficulty of the screen — how close the green obstacles are to each other.
L	The number of lives used up.
U	the score and how many screens have been passed, also the number of blue obstacles.
V	The character at position A before the runner is plotted.
X	A non-variable number — 300 — is used only to keep line 10 possible.
Z	Beginning of the For-Next loop in 10, if the runner crashes when he is on a screen his score on that screen is recorded and is carried on to the next man.
A$	What is input on the keys — used to make key testing even.

The game uses the left and right cursor keys only. But it must be borne in mind at all times that left and right apply to the runner and not to the user.

At the start of the game you have three seconds to decide which way you want to go, and pressing no key means you will go straight upwards.

Line 0 defines all the variables which do not start at 0, and decides whether to Goto the normal grid screen or the maze screen.

Line 10 defines the size of the main For-Next loop — how far the runner has to go — and alters the direction of the runner, F, when a key is pressed.

Line 20 alters the position of the runner — makes the runner move in the direction indicated by the key, and finds out which character occupied the position the runner now occupies. Line 30 determines if this character is an obstacle, and contains instructions for the completion of a grid.

Line 40 contains the set of instructions for the runner hitting an obstacle.

Lines 50 to 80 set the screen — place the random blue dots, and draw the grid. They also type the name of the game at the top of the screen.

Lines 100 to 120 set the maze screen.

Line 130 writes Open Gates at the top of the screen, sets up a repeat loop and alters the direction of the runner when a key is pressed.

Line 140 has the same function as line 20.

Line 150 opens the gates into the maze when the runner passes beneath the Open Gates sign. Line 160 finds out if you have reached the centre of the maze. Lines 170 and 180 have the same function as line 40. Lines 200 to 220 contain the set of instructions for reaching the centre of the maze. ■

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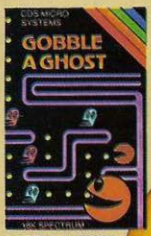

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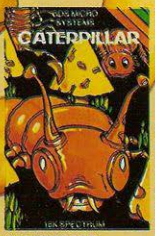

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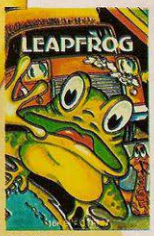

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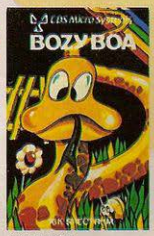

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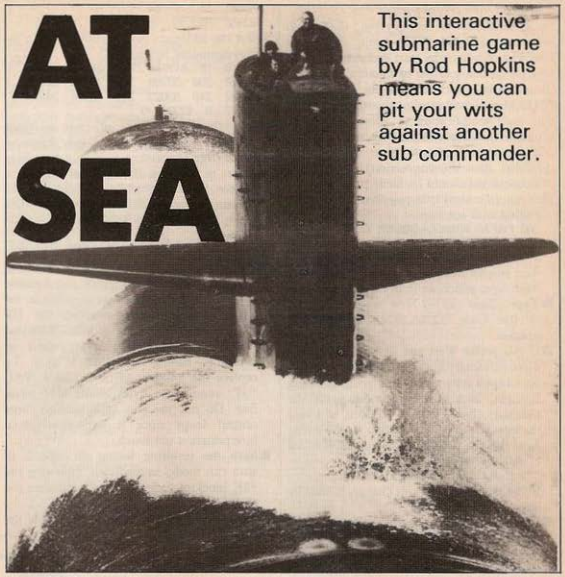
DUEL AT SEA

This interactive submarine game by Rod Hopkins means you can pit your wits against another sub commander.



HERE, AS PROMISED in the August issue, is the dual computer version of Submarine Mission. Enough time has been allowed for fledgling commanders to get their torpedo eye in with the solo program. Now for the moment of truth — a real-life opponent.

To link up two Spectrums for our present purpose clearly demands some hardware. In fact, I have written the I/O-handling routines of the program around the Programmable Sound Generator and I/O board — PSGIO — used for the Mozart minuets featured in the March edition of *Your Computer*. This interface constitutes perhaps a little more than a minimal solution to the I/O needs of Submarine Mission, but was chosen nevertheless for several reasons.

In the first place, a considerable number of readers already have a PSGIO board. Secondly, with such versatile sound and I/O capabilities, it can lay some claim to being the most useful general-purpose add-on for the Spectrum. Finally, the circuit can be very easily built by home constructors, or bought ready-built for a very reasonable outlay. This is not to say that other I/O interfaces might not be used. Indeed, machine-code adepts should find modification of the relevant handful of routines a very straightforward matter.

As a simulation for two Spectrums and their commanders, Submarine Mission adds a novel exciting extra dimension to home computing; the atmosphere and tension are of a different order. But for all that, the dual system is simply achieved. During each major program loop, one of the computers — shall we say the master — will inform the others — the slave — that it has data ready to send.

Meanwhile, every 20 mS the slave polls the master to check whether data is ready. If this should be the case then the slave will receive data, on completion of which roles are exchanged, the slave becoming the transmitter. The roles of master and slave are established automatically during initialisation — line 9900 on — and are retained through program restarts. Through the same process of priority assertion, tide strength and direction are agreed upon at the same time.

Polling at 20 mS intervals is achieved by putting the slave computer into interrupt mode 2 and extending its service routine to include reading the PSGIO input port. This method of synchronising transfer has the great advantage that the performance of one computer does not degrade that of the other.

Since two-state flags indicating critical status information are being transmitted, integrity of data is important. For this reason, handshaking has been employed during exchanges, as has checksum verification. The former is an electrical version of announcement and acknowledgement, while a checksum is some numerical function of the data sent, appended to that data, and used by the receiver to verify the data.

Hardwired lines not being available, handshaking was realised by using the upper four bits of both ports as handshaking bits, the lower nybble being reserved for data. This involves a certain amount of processing of both data for transmission and data received.

For each computer, parallel to the six variables transmitted there are six relating to the enemy submarine. Each computer formats and sends it own variables, receives, formats and assigns enemy data to the parallel set. The variables concerned are shown in table 1.

Table 1.

s/us	*own/enemy latitude*
w/uw	*own/enemy longtitude*
dpt/udp	*own/enemy depth*
su/usu	*self/enemy submerged*
al/ual	*self/enemy alive?*
ht/uht	*enemy/self hit?*

Let me emphasise at this point that the dual version of Submarine Mission is very much an extension of the solo edition, rather than a separate entity. For the most part in fact, it is the same beast with additions being mainly concerned with I/O.

Therefore the assumption is made that the

(continued on next page)

Figure 2. Machine-code routines.

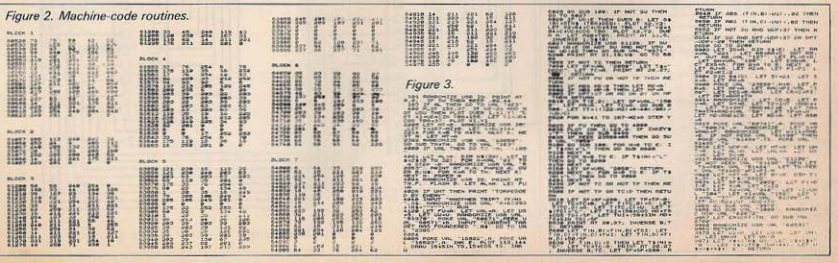


Figure 3.

(continued from previous page)

reader taking on the task of typing in the dual program has already made a copy of the solo one. Figure 1 lists the start addresses of main new components of the two computer set-up; those marked with an asterisk involve the PSGIO board, and are thus the routines which will need modification to allow use of the program with any other interface.

If the steps outlined below are followed carefully, then the conversion from solo to dual operation should be fairly painless.

- Write your own title page/header program ending with the lines:

```
200 PAPER 0:INK7:BORDER 7:
    CLEAR 32767
210 LOAD " CODE:LOAD " "
```

  Save this in autorun mode at the start of a fresh tape, which we shall refer to as tape 2.
- Type Clear 32767:New and then load in the Code 32768,32768 of the solo progam.
- If you prefer West and East to be in their more customary quarters, and assuming you have kept a copy of the Chartroom Drawing Routine, load in this routine, make the necessary change to line 140, Run, and Save the new screen$ on a different tape. Having done that, Load it back into your 32K block of code by typing,

  LOAD " "CODE 32768,6912

  If you intend making this change, it must be done at this stage.
- Using the loader routine given in the August issue,page 112, top left, enter the seven blocks of code given in figure 2. If this job is tackled in more than one sitting, always save and reload using

  CODE 32768,32768
- Carefully enter the following as a directly executed line:

  FOR n=63755 TO 63581 STEP-1:POKE n+8, PEEK n:NEXT n

  Poke in these bytes to the eight sequential addresses beinning 63581:

63581 85 72 84 197 85
63586 65 76 197

- For the addresses listed below, Poke in the corresponding bytes:

63379 15 61101 21 61498 0 61499 0
32768 206 32769 249 32896 206
32897 249 33023 206 33024 249
62372 0 62373 0

Save the entire block of code as Code 32768,32768 on tape 2 immediately following the title page program.

Changes to the Basic listing are as follows:

- Delete line 160, which should not be present in the solo version either. Also line 6004, lines 7055 to 8660 and lines 9903 onwards.
- Type in the lines given in figure 3.
- Using the Val function and combinations of assigned variables, compress non-dynamic parts of the program as far as possible, for example the Position routine, the Hit routine and the Disaster routine. Note that variables A through H are used as constants, having the values 0 to 7. To replace the number 35 for instance, VAL "35" saves three bytes, while H*F saves five. Do not use this technique in time-critical loops since it will slow down interpretation too much.
- Save the resulting listing on tape 2 in auto run mode, immediately following the 32K block of code. This will complete the recording.

It will be noted that in both versions of the program, sound has been generated using the Spectrum beeper. The method has been retained in the dual version both to make the conversion more straightforward and to allow room for individual taste which varies greatly in this area. Needless to say, the soundboard is capable of far grander things than the beeper, and is simplicity itself to program. Lack of space precludes a full discussion of sound programming in this context. Suffice it to say that the sound chip is programmed in two-step packets:

(i) Point to a register — 0-13 as far as sound is concerned — by executing an Out (221), Reg No instruction in Basic or machine code.

(ii) Send data to the register by executing an Out 223, byte instruction, again either in Basic or machine code.

(continued on page 139)

Figure 4a.

```
  5 [redacted]
 10 INPUT "reg? ";r: OUT 221,r;
 INPUT "value? ";v: OUT 223,v: I
NPUT "ENTER to continue,V to vie
w ";a$: IF a$="" THEN GO TO 10
 15 INPUT "DUMP TO PRINTER?";n
$: IF n$[1]="Y" THEN OPEN #2,"p":
 20 INPUT "TILES? ";t$: PRINT T
$;: FOR n=0 TO 15: OUT 221,n: P
RINT "reg ";n;TAB 10;IN 221 HEX
 10: PRINT "": CLOSE #2: GO TO
 10
```

Figure 5.

```
PSGIO SOUND ROUTINES

62900 6    13   120  211  221
62905 126  35   211  223  16
62910 247  175  211  221  126
62915 211  223  201  0    60
62920 0    16   15   16   120
62925 0    0    0    0    41
62930 0    42   33   198  245
62935 205  100  245  201  0
62940 255  0    16   16   16
62945 54   0    0    0    0
62950 0    10   0    33   219
62955 245  205  180  245  201

62933  ASDIC PING ROUTINE
62953  MUFFLED EXPLOSION ROUTINE
```

Sample register set-up.

```
GRANDMA'S CLOCK

REG 0   200
REG 1   0
REG 2   255
REG 3   0
REG 4   100
REG 5   0
REG 6   0
REG 7   120
REG 8   16
REG 9   16
REG 10  16
REG 11  0
REG 12  80
REG 13  8
```

Figure 4b. Bit manipulation in decimal.

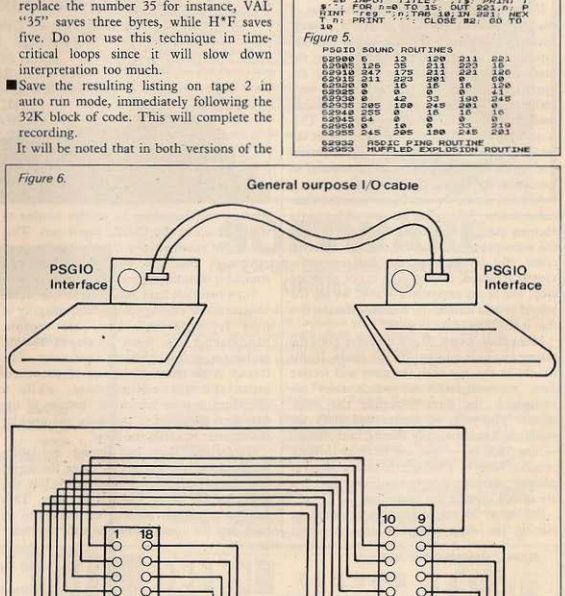
BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0	
1	1	1	1	1	1	1	1	=255
128	64	32	16	8	4	2	1	
1	0	1	1	0	0	1	1	=179
128	0	32	16	0	0	2	1	

Register 7 bit functions.

1 = O/P 0 = Channel ON
0 = I/P 1 = Channel OFF

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
I/O	I/O	C	B	A	C	B	A
B	A	NOISE			TONES		

Figure 6.



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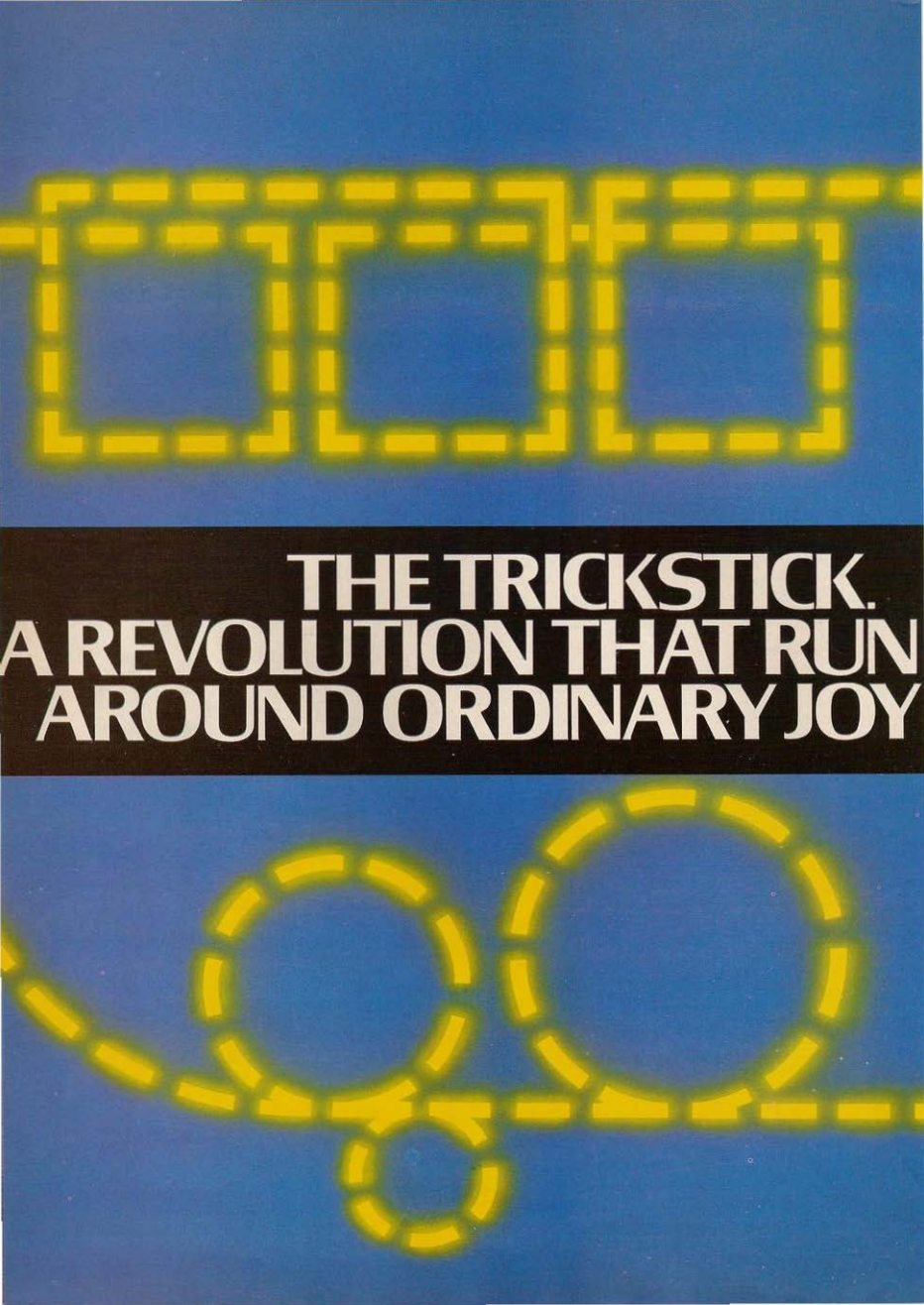
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DRAGON

(continued from page 134)

Figure 4 summarises the function of each PSG register, 4b gives a break-down of bit functions of register 7 along with an example of bit manipulation in decimal, and a routine with example for experimenting with sound in Basic. For more detail, readers might refer back to the March issue of *Your Computer*.

Figure 5 lists the code for a general purpose PSG subroutine — at 62900 — and two other routines to replace the beeper in Basic program lines 2240, 4000, 101, 145, 365 and 4000. To use the routine at 62900 for your one sound effects is very straightforward, as I will show: find a spare slot in RAM. Immediately following the figure 5 code up to 63231 is free and having decided on the required register data using the Basic experimenting routine, store it in 14 sequential addresses in descending register order. That is, register 13 first, register 0 last. From the next free address, enter a seven-byte routine:

```
ld hl, start address of register data
call 62900
ret
```

Thus, 21 bytes in all are needed for each extra routine; a very small overhead indeed. Klaxon, lieutenant.

Figure 6 shows the schematic of the two-computer link. Both computers use precisely the same program. Now during initialisation, Port A is set up to output, Port B to input. It follows therefore that communication is managed by connecting one computer's Port A to its opposite number's Port B and vice versa. For home constructors, probably the easiest method of constructing the link would be to buy a pair of 18-pin dual-in-line header plugs, and using flexible stranded wire, hardwire according to figure 6. For those without the resources of confidence, an easier solution is offered at the end of the article.

Whatever, both ports are TTL-compatible and can easily drive the couple of feet of cable required. The circuit diagram of the PSGIO board is given in. It uses nothing that is not readily available, and presents no constructional problems. It is worthwhile emphasising that once acquired, the board and cable can perform an endless variety of interfacing tasks effectively: D to A or A to D, joysticks, sound to light units, serial or parallel printers, perhaps even a little power station or two!

I/O programming follows the same format as that for sound generation. First of all, set up the ports to the desired configuration. Bits 6 and 7 of register 7 determine the latter, controlling Port A and Port B in that order. A logic 1 in the appropriate bit sets the corresponding port to output mode and vice versa, so that

OUT 221,7:OUT 223,255

would place both ports in output mode; whereas

OUT 221,7:OUT 223,127

leaves Port A in output mode, Port B in input mode. Registers 14 and 15 act as data stores for ports A and B respectively, so with A set to output,

OUT 221,14:OUT 223,237

would establish the data byte 237 on the port A pins of the expansion socket. Similarly, with B set to input,

OUT 221,15:PRINT IN 221

will return whatever data is present on the B pins of the socket. With nothing connected those pins would float at around two volts, sufficient to be seen as logic 1s, giving the aggregate result of 255. That's all there is to it.

Switch off both computers before connecting the soundboards; plug in the cable at both ends before switching on. After switch-on, if either party intends to do any experimenting with the soundboard, both should first type

OUT 221,7:OUT 223,127

Then, when using register 7 for sound control, ensure that any number loaded into it is greater than 63 and less than 128. This of course, only applies when two boards are linked together. Both computers could Load Submarine Mission at the same time if a simple T-junction adaptor is made to insert between their ear sockets and the ear socket of the tape recorder. If by any chance, one of the computers should crash for whatever reason, it would be wisest to switch both off.

A cassette carrying both the solo and dual versions of Submarine Mission, the PSGIO interface and the cable can all be obtained, the hardware fully built and tested, from Protek Computing, Clydesdale Bank Buildings, South Queensferry, Midlothian. the prices are:

Cassette: £5.99
PSGIO interface: £19.25.
I/O cable: £4.75.

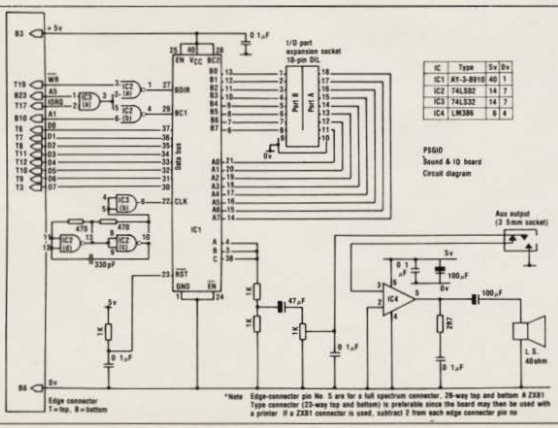
Figure 1. Extra machine-code routines for dual Submarine Mission

*60531	*Master or Slave?*
*61057	*Call IO*
*61200	*Set tide*
61553	*Output sort*
61640	*Clear buffers*
63850	*Split byte*
63870	*Output checksum*
63900	*Input checksum*
63950	*Int Service Routine*
63986	*Int Mode 2*
63993	*Int Mode 1*
64650	*Input sort*
*64800	*Input*
*64875	*IO Ready?*
*64900	*Output*

Figure 4. PSG register functions:

Register	Function
0	set Channel A tone period (LO)
1	set Channel A tone period (HI)
2	set Channel B tone period (LO)
3	set Channel B tone period (HI)
4	set Channel C tone period (LO)
5	set Channel C tone period (HI)
6	random noise period all channels
7	enable noise and/or tone on all channels, control IO direction.
8	channel A amplitude (0 to 15)
9	channel B amplitude 16 gives
10	channel C amplitude ENV CONTROL
11	envelope period all channels (LO)
12	envelope period all channels (HI)
13	define envelope shape
14	IO Port A data store
15	IO Port B data store

Figure 7.



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WORK FORCE

THE BIGGEST LITTLE SOFTWARE HOUSE AROUND

DO NOT PASS GO

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D N P G is a complete simulation of THAT BOARD GAME you know PARK LANE and all that Up to SIX PLAYERS can compete with the MICRO doing all the work Acts as DICE THROWER BOARD RENT COLLECTOR UM PIRE BANK RULE BOOK ACCOUNTANT ES TATE AGENT and ASSET RECORDER SUPERB GRAPHICS by GARRY KENNEDY (thanks mate) GAME SAVE with winner so far report Complete with full instructions The ULTIMATE in FAMILY GAMES DON'T MONOPOLISE YOUR MICRO AMAZE your friends and family (Can you imagine your GRANNY on a MICRO?) A 16k ZX81 version also available. 48k SPEC TRUM or 16k ZX81 versions **ONLY £6.95.**

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Spectrum SCRAMBLE (Condition Red) EIGHT DIRECTIONAL KEYS All MACHINE CODE LASERS, BOMBS, ROCKETS, INSTANT RESPONSE, CONTINUOUS SCORING, SOUND, FUEL DUMPS, RED METEORS, DEFENDER CRAFT and HIGH SCORE BEWARE CONDITION RED you must REFUEL THE REVIEWERS DIDN'T GET TO THE FINAL STAGE 16 & 48K SPECTRUM **JUST £4.95.**

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An advanced SPECTRUM TOOLKIT Compressed of just 1450 BYTES of POSITION INDEPENDENT MACHINE CODE RENUMBER lines or blocks Allows START, FINISH INCREMENT and new START to be defined BLOCK or line MOVE including RENUMBER to fit available GAP RENUMBER will renumber ALL GOTO GOSUB, LIST etc without further action CHANGE strings (NAMES or CONTENTS) DUMP VARIABLE NAMES and CONTENTS to DISPLAY PROGRAM SIZE with or without VARIABLE SIZE This package is FAST, CLEAN, PRODUCES ERROR MESSAGES and is WELL DOCUMENTED S USER "WORKS LIKE A DREAM" SPECTRUM ONLY **£6.95.**

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A WORD PROCESSOR FOR THE SPECTRUM SHIFTY was designed to overcome the limitations of the standard SINCLAIR HARDWARE specifically the PRINTER Using the STANDARD PRINTER all output over 32 CHARACTERS PER LINE is PRINTED SIDEWAYS allowing pages to be formatted from the printer paper Are widths from 20 to 80 characters per line may be specified Text can be viewed prior to printing and can be JUSTIFIED to the RIGHT MARGIN SHIFTY will WORD SEARCH, MOVE PARAGRAPHS, SPLIT PARAGRAPHS, APPEND PARAS, SAVE and LOAD from TAPE, INDENT PARAS and allow standard PHRASES to be STORED and accessed from DATA STATEMENTS using DEFINED KEYS EDITING is ON SCREEN using 4 way CURSOR MOVE SHIFTY comes complete with a sample letter and full instructions Requires ZX printer **ONLY £7.50**

NEW RELEASE "JAWS REVENGE" 48k SPECTRUM

Disappointed with his box office returns JAWS brings his GORY EATING HABITS to the SPECTRUM in his very own ARCADE GAME JAWS eats his way through a mixed diet of DIVERS, BOATMAN, JELLYFISH, SWIMMERS and FISH You control JAWS in this FAST MOVING trail of carnage Avoid DEPTH CHARGES, EXPLODING JELLYFISH, HARPOONS ARMED SCUBA DIVERS and EAT everything you can 5 LIVES, SCRAMBLE type SEA BED, current and HIGH SCORE ALL MACHINE CODE and FAST DEMO SCREEN BONUS LIVES FASTER GAME FOR 10,000 POINTS WREAK HAVOCK ON THE HUMAN RACE "THE BEST GAME YET ANIMAL RIGHTS MOVEMENT" 16 & 48k SPECTRUM **£5.00.**

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DISPLAY

How would you like 273 different USER DEFINED GRAPHICS on a 16k SPECTRUM or a FULL 336 on a 48k All can be displayed on screen at the SAME TIME U D G's are stored as PAGES and any two pages may be EXCHANGED in MEMORY FILES may be SAVED or LOADED from TAPE at a USER specified location TURN a UDG one quarter or half turn FLIP a UDG over, REVERSE a UDG, EXPAND a quarter UDG into a FULL CHARACTER MOVE a UDG one PIXEL at a TIME, UP, DOWN, LEFT or RIGHT FIVE complete TAPE FILES are INCLUDED on tape ONE CONTAINING a 64 CHARACTER DISPLAY DESIGN GRID for constructing CHARACTERS and SHAPES FULL INSTRUCTIONS and ANIMATED DEMO SCREEN **£7.00.** 16 & 48k SPECTRUM

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"CLONE" is probably the BEST BACK UP TAPE around We are confident it will make BACK UP COPIES of your current SOFTWARE CLONE will COPY both HEADERLESS and STANDARD TAPES CLONE will PROTECT your SOFTWARE INVESTMENT by ensuring you have BACK UP AS PROTECTION routines are COPIED and a simple method of loading is GIVEN If you want a COPY TAPE then BUY the BEST CLONE is AVAILABLE on the STRICT UNDERSTANDING THAT IT WILL NOT BE USED TO INFRINGE COPYRIGHT TAPES up to 38k can be coped, COPIES are made of each program as it appears on tape UNLIKE SOME COPY TAPES "CLONE" DOES NOT NEED TO BE RELOADED AFTER EACH SAVE CLONE copies TAPES that can't be BROKEN INTO USE our knowhow for just **£5.00.** ALL SPECTRUM P S CLONE WILL COPY MOST COPY TAPES SHOULD YOU WISH

THE PROGRAMS ON THIS PAGE ARE ONLY AVAILABLE FOR SINCLAIR COMPUTERS 16K ZX81

CONDITION RED	£3.95
TOOLKIT	£5.00
ADVENTURE IN TIME Nearly 60k of ADVENTURE in parts for the 16k ZX81	£7.00
WINGED AVENGER	£4.50
DO NOT PASS GO	£6.95

Most programs available from BUFFER, MICROWARE, SOFTWARE SUPERMARKET, GREENWELDS, HEFFERS, JOHN MENZIES and selected SPECTRUM COMPUTER FRANCHISES DEALER ENQUIRIES WELCOME

WORK FORCE

140, WILSDEN AVENUE
LUTON BEDS.

Post Included

Listing 1. Loader program.

```
  10REM FOR £ READ
HASH CHARACTER
  3100SWERCH=&FFEE
  320FOR opt =0 TO 2
 STEP 2
  330PX=&D10
  340 [OPT opt
  350 .MOOV
  360LDA £&0
  370STA &70
  380LDA £&30
  390STA &71
  400LDA £&80
  410STA &72
  420LDA £&2D
  430STA &73
  440 LDX £0
  450.LOOP LDA (&70,
X)
  460TAY
  470LDA (&72,X)
  480STA (&70,X)
  490TYA
  500STA (&72,X)
  510CLC
  520LDA &70
  530ADC £1
  540STA &70
  550LDA &71
  560ADC £0
  570STA &71
  580CLC
  590LDA &72
  600ADC £1
  610STA &72
  620 LDA  &73
  630ADC £0
  640STA &73
  650LDA &70
  660CMP £&80
  670BEQ CHECK
  680JMP LOOP
  690 .CHECK LDA &71
  700CMP £&32
  710BEQ FINISH
  720JMP LOOP
  730 .FINISH LDA £7
  740JSR OSWERCH
  750RTS
  760]
  770NEXT
  780VDU 23,224,&00,
&00,&00,&18,&18,&00,
&00,&00
  790VDU 23,225,&01,
&02,&04,&08,&10,&20,
&40,&80
  800VDU 23,226,&01,
&00,&04,&00,&10,&00,
&40,&C0
  810 VDU 23,227,&08
,&1C,&08,&08,&08,&08
,&1C,&08
  820 VDU 23,228,&08
,&1C,&00,&08,&00,&08
,&1C,&08
  830 VDU 23,229,&00
,&00,&08,&1C,&3E,&7F
,&00,&00
  840VDU 23,230,&00,
&7E,&7E,&7E,&7E,&7E,
&7E,&00
  850VDU 23,231,&18,
&3C,&7E,&FF,&FF,&7E,
&3C,&18
  860VDU 23,232,&18,
&24,&42,&81,&81,&42,
&24,&18
  870!&D60=&05004500
  880!&D64=&05011D00
  890!&D68=&55021D01
  900!&D6C=&55015503
  910!&D70=&00000501
  920 CHAIN""
```

Fintan Culwin describes a drawing program for the BBC.

THIS MODERATELY sophisticated graphics drawing system for the BBC Micro was initially designed for use with a digitising tablet but has been revised for use with joystick or keyboard.

Previous developments of this idea have reserved a part of the screen for the menu. This has the advantage of allowing all the menu choices to be referenced directly; the disadvantage, however, is that part of the screen which could be used for drawing has been sacrificed.

This is a particular disadvantage if you are using the system to produce a picture for a different application. Part of the specification for this system has been for the menu to only be on screen when it is called. This was achieved by a short machine-code routine which will exchange the top of the screen for a reserved block of memory below Himem. When the menu is required the code will change the screen for menu memory and then re-exchange them when the menu is no longer required.

Other parts of the specification allow for plotting points, continuous lines and dotted lines freehand; plotting continuous and dotted lines by leaving a marker, producing triangles and quadrilaterals by leaving two or three

(continued on page 143)

The Lightening Oric Assembler. £9.90*

There are other assembler/editors available for the ORIC but none combine the same features and ease of use that we have obtained with this comprehensive utility program for the ORIC 48K. The manual which accompanies the assembler gives a brief insight into machine code and the use of assemblers to enable anyone to write in assembly language after just a little study. Full specifications of the assembler cannot be fitted into the small space available here and so they may be obtained from your local dealer or direct from Mr Micro.

*Includes comprehensive instruction booklet

Crazy Golf £6.90
48K Spectrum

Crazy golf is a new program for the 48K Spectrum you are required to clear the course avoiding and circumventing the many strange obstacles finally putting your ball in the hole. The par for each hole is displayed and a novel direction indicator combined with a force indicator enable you to send the golf ball in the direction you feel is the best one to clear the course. Crazy golf really is crazy but most of all it is fun and will be found to be very enjoyable by all members of the family.

For use with Joystick and keyboard

Bengo £6.90
Vic 20

An exciting program for the unexpanded Vic 20, which combines fast moving strategy and reflex skills. You must control Bengo the super Eskimo against the dreadful snow Yeti. Half bind and half witted the Yeti can smell a good Eskimo lunch — the only protection Bengo has is to hurl huge blocks of ice across the frozen waste at the Yeti.

Don't get distracted — or you'll be personally responsible for the demise of an Eskimo!

For use with Joystick

Dracula £6.90
48K ORIC

A superb adventure for the 48K ORIC. This adventure is written in the good old style! No silly graphics, no gratuitous drawings, no distractions from pure mental images of horrendous realism. This evocative text adventure of the old genre will have Oric owners shivering with anticipation and perhaps fear.

Dare you load DRACULA into your ORIC 48?!

By keyboard

No shocks – Plenty of surprises!

Mr. Micro means programs you can trust. Programs that are as exciting when you load them as they look at your dealer. Programs that come proven and refined. Programs that bring you the breathtaking excitement of arcade games with the special extra dimension of real mental challenges — all at the right price. Plus accessories and utilities which extend the value of your computer. Ask for Mr. Micro by name at your local dealer. Or order your games direct, post-free, from: Mr. Micro Ltd. 69 Partington Lane, Swinton, Manchester M27 3AL. Cheques should be made payable to Mr. Micro Limited. Ring our 24 hour hot-line for payment by Access or Visa on: 061-728 2282.

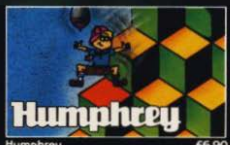
Amigo £6.90
Vic 20 8K or 16K expansion.

Hey Amigo you gotta run fast ah. The banditos they are a chasing you and they wil a gete you if a you do nota escapa OR. You musta runa rounda the blocka when you run round de corners ofa de city the banditos they are frightened to go there and you score de points. Pity you have nota gota gun but a joystick can be fun.

For use with Joystick

Digger £6.90
Vic 20 8K or 16K expansion

Your remote viewer shows the path of the professor's devilish digging apparatus. Using your computer linked remote control you must guide the digger beneath the earth to collect the rare micronite gems. Unfortunately the micronite is protected by the micronits who will plague your machine in order to attempt to stop its progress. You may be able to kill the micronits by skilfully manoeuvering your digger beneath a subterranean structure which will then fall killing any micronit in its path. This is a novel implementation of a popular arcade game. For use with Joystick



Humphrey £6.90
Vic 20 BBC Model B

This new game for the BBC Model B or for the VIC 20 (8K or 16K expansion) and also for C.B.M. 64 moves some thirty decades taking.

Object of game is to make Humphrey land on all the cubes thus changing their colour. Unfortunately Humphrey is being chased by a bouncing ATOMIC BOMB! You will soon know that this deceptively simple game has tremendous addictive properties and quite a high degree of tactical skill.

For use with keyboard or Joystick

Mysterious Island £9.90
Vic 20 16K

Escape from prison in a hot air balloon — try to land it on Mysterious Island: then the fun really begins. ● Booby Trapped Fields ● Killer Bees ● Hostile Natives ● Hidden Clues ● Force Fields ● Capture the Nautilus ● Full Graphic Display ● Several Games lead to Exciting Climax ● Separate Practice Program ● Includes Blank Data Tape to store the game to play later.

All successful adventures can claim a unique personalised award by sending Mr Micro their final position at the end of the game.

By Joystick or keyboard

RAMDAM £13.90
Vic 20

This accessory enables programs which would normally only work with 5K expansion to work with 8K or 16K expansion. RAMDAM saves having to buy a 5K pack if you already own an 8K or 16K. With RAMDAM and a Commodore 16K expansion all known tape games will run on your Vic 20. ● Includes Memory Test Program ● Free 6 5K game MICROVADERS for use with Joysticks.

Punchy £6.90
Spectrum 484

Punch has taken Judy for his evil purposes and locked her away. Judy has called upon the forces of goodness to escape so with the help of our hero Bobby the policeman and you the purchaser of this fine program you must guide brave Bobby across the stage to rescue poor Judy. Leap the gaps. Jump over the dogs. Leap the alligator pit. Dodge the tomatoes. Rock the crib. Collect the sausages and finally rescue Judy. By Hampstone joystick or keyboard

Dragon Tamer £9.90
Dragon 32

Allows Atari type and other digital joysticks to be used with the Dragon — giving better response and more control. For the first time your Dragon will be able to reflect your true skills. ● Achieve higher games scores ● Less Frustration.

Plus To remove maximum value Dragon Tamer includes two original games for use with digital joysticks.

Goldrush £6.90
Vic 20 3·5k

This graphic adventure program was the first in the world to offer real gold for the successful adventurer. An idea which has been much copied but never equalled. ● Fun ● Educational ● Challenging ● Clues ● Puzzles ● Searches ● Fast Reaction Game. For use with keyboard

(continued from page 141)

markers; and the production of filled or open circles by leaving one marker.

The main program uses the 16-colour mode, and makes use of all 16 colours. This takes 20K of memory, so memory for the program is at a premium. This led to splitting the system into two parts. The first part — listing — is used to assemble the code for the memory exchange routine; set the user-defined characters; initialise a table which will be used by the main program and, finally, Load and Run the main program. It may also be useful for you to include the assembler code for a printer dump routine in this program, if you intend to use this facility.

The main program — listing 2 — is Chained automatically by the first program. It commences by constructing the menu and then exchanging it. You may just see it flash onto and off the screen after the program is loaded. Following this it asks for input indicating joystick or keyboard control and then allows for a previously-stored picture to be reloaded — definitely for disc owners only.

The program has two modes of operation: immediate and control. In the immediate mode the position of the cursor is indicated by a flashing horizontal cross. The cross can be positioned by using the joystick or by using the shift keys. In order to make this less tedious, pressing the shift key in combination with a cursor key will speed up the movement of the cross.

In order to cause output to the screen, either the fire button on the joystick, or the Return button on the keyboard has to be pressed. When using the freehand options output is immediate and, in the case of lines, is between the current point and the point last visited. In the non-immediate modes this either causes an offset flashing cross to be left as a marker or, if it is the last position needed, the whole shape is produced.

To assist in positioning the markers the system produces a line between the last marker and the current position of the cursor as the cursor is moved. This is known as rubber banding. If a cross is misplaced then pressing key X on the keyboard causes the last marker to be removed.

The screen can be cleared to the currently selected colour by pressing the C key in this mode and the printer dump, if installed, can be called by pressing the G key. By pressing the M key the menu can be called.

When the menu is on the screen the colour and function can be toggled. The menu is divided into two parts; the left-hand part is the colours available. The currently-selected colour is the one which is flashing, it can be toggled onto the next colour by pressing the C key.

The functions are displayed on the left of the menu. Again the currently-selected function is the flashing one and can be toggled by pressing the F key. In control mode the picture can be Saved by pressing the S key. In order to preserve the screen the cassette information system is turned off.

After pressing the S the recorder has to be prepared and when it is ready the Return key has to be pressed as usual. The cassette motor LED will light up and remain on until the file has been completed and the menu functions can be accessed again. This is, of course, automatic if you are using discs. To exit from control to immediate mode the M key is pressed again.

The keys have been chosen to have a mnemonic value. If you would like to reassign them then the negative Inkey values in the program will have to be changed. For details see page 275 of the user guide.

The structure of the program is quite straightforward. The main control routine between lines 180 and 360 directs to several high-level control procedures depending on which key is pressed. Proc-Readings will direct to one of two subservient routines — Joystick or Keyboard — depending on the input mode, and update the global variables X% and Y% which are the cursor position.

Proc-Control first calls the machine-code routine labelled by MOOV% and then directs to either Proc-Function, Proc-Colour or Proc-Save to achieve the control functions until the M key is pressed to exit.

Proc-Action is probably the most complex part of the system and depends upon three global variables Count%, Target% and Plot%. Target% and Plot% are dependent upon the current function. The values are stored in an unusual array. The array is stored in Page &OD and is initialised by loading.

The base address of the table is known and the offset is dependent upon the function value. This method is at a much lower level than array handling by basic and is only possible by the basic Pling operator.

Returning the Proc-Function; Target% represents the number of markers that have to be on the screen before output is called, Count% is the number already on the screen and Plot% is the Plot value needed in conjunction with the basic Plot command. The co-ordinates of the markers on the screen are stored in the conventional array P% (1,2).

So when Proc-Action is called, if Count% is less than Target all that is needed is for the current co-ordinates to be stored in the array, the value of Count% to be increased and a marker to be left on the screen. If Count% is equal to Target% then control is passed to one of the drawing routines. The simpler ones are contained within Proc-Action. ■

Listing 2. Main program.

```
100 MODE 2:HIMEM=HIMEM-700
110 PROC_INITIALISE
120 JOYSTICK=FALSE:KEYBOARD=FALSE
130 PRINTTAB(6)"PLOTTER 2";PRINTTAB(4)"EEEEEEEEE"
140      PRINT "    KEYBOARD' or JOYSTICK';PRINTTA
B(2)";" J/K ";
150 REPEAT:RESPONSE$= GET OR &20:UNTIL RESPONSE=106
OR RESPONSE=107
160 IF RESPONSE=106 THEN JOYSTICK=TRUE ELSE KEYBOA
RD=TRUE
170PRINT  "Press  P  to load" "a picture," "or  C
to continue ";
180  REPEAT: RESPONSE=GET OR &20:UNTIL RESPONSE=99
OR RESPONSE=112
190  IF RESPONSE=99  THEN 220
195 *OFT 1,2
200 *LOAD "PICTURE"
205 *OFT
210 GOTO 230
220 MODE 0,128 : CLS : GCOL 0,128=colour%
230  X%=500: Y%=500
240 REPEAT
250 oldX%=X% : oldY%=Y%
260 PROC_CROSS(0,oldX%,oldY%)
270 PROC_READINGS
280 PROC_CROSS(0,oldX%,oldY%)
290 IF INKEY(-102) THEN PROC_CONTROL
300 IF INKEY(-83) THEN CLS :count%=0
310 IF INKEY(-67) AND count%>0 THEN PROC_CROSS(45,P
%(0,count%-1),P%(1,count%-1)) : count%=count%-1
330IF JOYSTICKS AND (!&D&M,0) AND 3) > 0) THEN PROC
_ACTION:FORN=0 TO 50:NEXT
340 IF KEYBOARDS AND INKEY(-74) THEN PROC_ACTION
350 IF INKEY(-84) THEN PROC_GRAPHIC
360 UNTIL FALSE
1000 DEF PROC_INITIALISE
1010 *FX 4,1
1020 VDU 23,1,0,0;0;0;
1070 FOR MX=HIMEM TO HIMEM+700 STEP 4 :?MX=0 : NEXT
1080 FOR MX=&D0 TO 232 : symbol=symbol+CHR$(MX) : N
EXT
1090 DIM PX(1,2)
1100 count%=0 : TYPE%=1 : plot%=5 : TARGET%=0
1110 colour%=7 : MODE%=&D010
1120 *FX 10,5
1130 FOR MX=0 TO 7 : COLOUR MX : PRINTTAB(MX,0)CHR$(2
30) : NEXT
1140 PRINTTAB(10,0)symbol$
1150 COLOUR15 : PRINTTAB(7,0)CHR$(230) : PRINTTAB(11
,0)CHR$(229) : COLOUR 7
1160 CALL MOOV%
1170 GCOL 0,colour% : GCOL 0,colour%+128
1180 ENDPROC
2000 DEFPROC_READINGS
2010 IF JOYSTICKS THEN PROC_JOYSTICK ELSE PROC_KEYBOA
RD
2020 ENDPROC
2100 DEF PROC_RUBBER_BAND
2106 PLOT 4,P%(0,count%-1),P%(1,count%-1)
2107 PLOT 22,X%,Y%
2108 ENDPROC
2300 DEF PROC_JOYSTICK
2310 X%=X%+(!&D&M,3) DIV &B1-&4:+&1280
2320Y%=!&D&M,4) DIV &B1-&0
2330ENDPROC
2400DEF PROC_KEYBOARD
2410IF INKEY(-26) THEN X%=X%-FN_SHIFT
2420IF INKEY(-122) THEN X%=X%+FN_SHIFT
2430IF INKEY(-58) THEN Y%=Y%+FN_SHIFT
2440IF INKEY(-42) THEN Y%=Y%-FN_SHIFT
2450ENDPROC
2500 DEF FN_SHIFT
2510 IF INKEY(-1) THEN =40 ELSE = 8
3000 DEFPROC_CROSS(angle%,X%,Y%)
3004 GCOL 3,colour%
3005 IF angle%=0 AND TARGET% > 0 AND count% > 0 THEN
PROC_RUBBER_BAND
3010 LOCAL x%,y%
3020 IF angle%=0 THEN y%=0 ELSE y%=50
3030 x%=50
3050 PLOT4,X%,Y%:PLOT2,x%,y%
3060 PLOT4,X%,Y%:PLOT2,-y%,x%
3070 PLOT4,X%,Y%:PLOT2,-x%,-y%
3080 PLOT4,X%,Y%:PLOT2,y%,-x%
3090 PLOT4,X%,Y%
3100 GCOL 0,colour%
3110 ENDPROC
3500 DEFPROC_CONTROL
3510 CALL MOOV%
3520 PROC_noCROSS
3530 ENDPROC
3540 REPEAT UNTIL !&D&M,10)=0
3550 FOR MX=0 TO 500:NEXT
3560 IF INKEY(-83)  THEN PROC_COLOUR
3570 IF INKEY(-68)  *EN PROC_FUNCTION
3580 IF INKEY(-82)  THEN PROC_SAVE
3590 UNTIL INKEY(-102)
3110 CALL MOOV%
3120 ENDPROC
3400 DEF PROC_noCROSS
3410 IF count%=0 THEN =0&0
3420 FOR MX=0 TO count%-1
3430 PROC_CROSS(45,P%(0,MX),P%(1,MX))
3440 NEXT
3450 count%=0
3460 ENDPROC
3500 DEFPROC_COLOUR
7010 VDU 7
7020 VDU 4 : COLOUR colour%
7030 PRINTTAB(colour%,0)CHR$(230)
7040 colour%=colour%+1: IF colour% = 8 THEN colour% =
0
7050 COLOUR colour%+8
7060 PRINTTAB(colour%,0)CHR$(230)
7070 COLOUR colour%
7080 GCOL 0,colour% : GCOL 0,128=colour%
7090 ENDPROC
8000 DEFPROC_FUNCTION
8010 VDU 7
8020 COLOUR 7
8030 PRINTTAB(10+TYPE%,0)MID$(symbol$,TYPE%+1,1)
8040 TYPE%=TYPE%+1 : IF TYPE%=7 THEN TYPE%=0
8050 COLOUR 15
8060 PRINTTAB(10+TYPE%,0)MID$(symbol$,TYPE%+1,1)
8070 TARGET%=?! &D&D+ TYPE%*2 )
8080 plot%=?! &D&D+ TYPE%*2+1 )
8090 ENDPROC
9000 DEFPROC_SAVE
9010 CALL MOOV%
9020 *OFT 1,0
9030 *SAVE "Picture" 3000 8000
9040 *OFT
9050 CALL MOOV%
9060 ENDPROC
10000 DEF PROC_ACTION
10010 IF count%<TARGET% THEN PROC_CROSS(45,X%,Y%) : P%
(0,count%)=X% : P%(1,count%)=Y% : count%=count%+1 : EN
DPROC
10020 IF TYPE%=3 THEN PLOT4,oldX%,oldY% : PLOT plot%,X
%,Y% : GOTO 10070
10030 IF TYPE%=5 THEN PROC_CROSS(45,P%(0,0),P%(1,0)) :
 PLOT 4,P%(0,0),P%(1,0) : PLOT plot%,X%,Y% : GOTO 1007
0
10040 IF TYPE%=5 THEN PROC_noCROSS : PLOT 4,P%(0,0),P%
(1,0) : PLOT 4,P%(0,1),P%(1,1) : PLOT plot%,X%,Y% : GO
TO 10070
10050 IF TYPE%=6 THEN PROC_GUARD:GOTO 10070
10060 PROC_CIRCLE
10070 count%=0:ENDPROC
11000 DEF PROC_GUARD
11010 PROC_noCROSS
11020 PLOT 4,P%(0,0),P%(1,0)
11030 PLOT 4,P%(0,1),P%(1,1)
11040 PLOT plot%,P%(0,2),P%(1,2)
11050 PLOT 4,P%(0,1),P%(1,1)
11060 PLOT 4,P%(0,2),P%(1,2)
11070 PLOT plot%,X%,Y%
11080 PLOT 4,P%(0,0),P%(1,0)
11090 PLOT 4,P%(0,2),P%(1,2)
11100 PLOT plot%,X%,Y%
11110 ENDPROC
12000 DEFPROC_CIRCLE
12010 LOCAL XDIFF%,YDIFF%,radius%,stepX%,stepY%
12020 PROC_CROSS(45,P%(0,0),P%(1,0))
12030 XDIFF%=ABS(X%-P%(0,0))
12040 YDIFF%=ABS(Y%-P%(1,0))
12050 radius%=SQR(! XDIFF% ^ 2 + YDIFF% ^ 2 )
12060 P%(0,1)= radius%
12070 P%(1,1)=0
12080 VDU 29,P%(0,0);P%(1,0);
12090 FOR I%=1 TO 91 STEP 9
12100 ang=COS(RAD(I%)) : stepX%=ang*radius%
12110 ang=SIN(RAD(I%)) : stepY%=ang*radius%
12120 PLOT 4,0,0
12130 PLOT 4,P%(0,1),P%(1,1)
12140 PLOT 4,stepX%,stepY%
12150 PLOT 4,0,0
12160 PLOT 4,-P%(0,1),-P%(1,1)
12170 PLOT plot%,stepX%,stepY%
12180 PLOT 4,0,0
12190 PLOT 4,-P%(0,1),-P%(1,1)
12200 PLOT plot%,-stepX%,-stepY%
12210 PLOT 4,0,0
12220 PLOT 4,P%(0,1),P%(1,1)
12230 PLOT plot%,stepX%,-stepY%
12240 P%(0,1)=stepX%
12250 P%(1,1)=stepY%
12260 NEXT
12270 VDU 29;0;0;
12280 ENDPROC
13000DEFPROC_GRAPHIC
13010
13020
13030REM PUT CALL FOR GRAPHICS DUMP HERE
13040
13050ENDPROC
```

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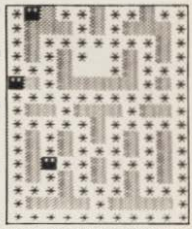
Listing 1.

```
10   PRINT "WRITE TO?  ";
20   INPUT A$
25   PRINT A$
30   GOSUB 620
40   LET C$ = ""
50   IF C$ = "" THEN INPUT C$
60   IF C$ = "S" THEN STOP
70   POKE X, 16 * CODE C$ +
CODE C$(2) - 476
80   PRINT AT 21, 0
90   SCROLL
100  GOSUB 660
110  GOSUB 540
120  LET X = X + 1
130  LET C$ = C$ (3 TO  )
140  GOTO 50
500  PRINT "ADDRESS?"
510  INPUT A$
520  GOSUB 620
530  GOSUB 660
535  GOSUB 540
537  LET X = X + 1
538  GOTO 530
540  LET C = PEEK X
550  GOSUB 640
560  PRINT B$, A$
580  RETURN
620  LET X = 4096 * CODE A$ +
256 * CODE A$(2) + 16 * CODE
A$(3) + CODE A$(4) - 122332
630  RETURN
640  LET A$ = CHR$
INT(C/16+28) +
CHR$(28+C-16*INT(C/16))
650  RETURN
660  RAND X
670  LET C = PEEK 16435
680  GOSUB 640
690  LET B$ = A$
700  LET C = PEEK 16434
710  GOSUB 640
720  LET B$ = B$ + A$
740  RETURN
```

ZX-81 MAZE CHASE



Speedy munchman Chris Bailey gobbles ghosts, pops power points and feeds on fruit to clear 16K of ZX-81 screen.

THIS MACHINE CODE VERSION of the popular Pac-Man game for the ZX-81 contains the main features of the original, including power points and fruit. The machine code is stored in a Rem statement 1025 bytes long. This is obtained in the following way. First, enter the first line:

```
1 REM 97 characters
```

Then, create lines 2 to 9 by editing line 1. Finally, obtain line 10 by editing line 1 and then adding one extra character. Now

```
POKE 16510,0
POKE 16511,3
POKE 16512,4
```

thus creating one long Rem statement numbered 0, so that it cannot be accidentally erased. Do not list this yet. To attempt to do so will put the display into an endless loop.

Now enter listing 1. This is a hex loader and hex lister program which works entirely in hexadecimal, including addresses. If the program is Run it asks for the starting address in hex. The machine code in listing 2 should now be entered starting with address 4082. A number of hex numbers can be entered together but they must be entered as pairs and not single characters. Once all the program has been entered, type S to stop the hex loader and then Save the program a couple of times on tape.

Now enter the following lines:

```
1 SAVE "MUNCHMAN"
2 POKE 16389,72
3 CLS
4 RAND USR 17192
```

and then delete the hex loader by entering the line numbers one by one and pressing Newline. Now Running the program will Save the game and then Run it. Before doing this, however, it is advisable to first enter as a command

```
RAND 65522
```

This is to ensure that a suitable number is in the random number seed. Some numbers cause the program to crash. If the program now Runs correctly, then you will now have a correct version recorded which will auto-run when re-loaded. If not, then you will have to go back to one of your original Saved versions to look for the mistake in the machine code. Run 500 will produce a listing.

Lines 2 and 3 are necessary in the final program as the program was originally written to fit into less than 2K and therefore uses the minimum display file.

(continued on page 147)

Listing 2.

```
4082  01 00 FF FF   Data
      0E 00 F2 FF
408A  06 22         ld b, 22
      21 3C 40      ld hl, 403C
      36 00         ld (hl), 00
      23            inc hl
      10 FB         djnz, FB
      2A 0C 40      ld hl, (400C)
      11 1F 00      ld de, 003F
      19            add hl, de
      22 3C 40      ld (403C), hl
      11 46 00      ld de, 0046
      19            add hl, de
      22 3E 40      ld (403E), hl
      11 0D 00      ld de, 000D
      19            add hl, de
      22 43 40      ld (4043), hl
      23            inc hl
      22 48 40      ld (4048), hl
      23            inc hl
      22 4D 40      ld (404D), hl
      11 1B 00      ld de, 001B
      19            add hl, de
      22 53 40      ld (4053), hl
40BB  21 00 15      ld hl, 1500
      2B            dec hl
      7C            ld a, h
      B5            or l
      20 FB         jr nz, FB
      3E 3E         ld a, 3E
      32 52 40      ld (4052), a
      21 56 40      ld hl, 4056
      34            inc hl
      CB 46         bit 0, (hl)
      CA 5B 41      jp z, 415B
40D1  3A 52 40      ld a, (4052)
      32 EB 40      ld (40EB), a
      32 3E 41      ld (413E), a
      C6 02         add a, 02
      32 19 41      ld (4119), a
      32 42 41      ld (4142), a
      C6 02         add a, 02
      32 F8 40      ld (40F8), a
      32 39 41      ld (4139), a
      2A 43 40      ld hl, (4043)
      7E            ld a, (hl)
      FE B2         cp B2
      20 05         jr nz 05
      21 96 01      ld hl, 0196
      28 46         jr z, 46
      3A 47 40      ld a, (4047)
      77            ld (hl), a
      E5            push hl
      2A 32 40      ld hl, (4032)
      54            ld d, h
      5D            ld e, l
      29            add hl, hl
      29            add hl, hl
      19            add hl, de
      29            add hl, hl
      29            add hl, hl
      29            add hl, hl
      19            add hl, de
      22 32 40      ld (4032), hl
      7C            ld a, h
      E6 06         and 06
      C6 82         add 82
      6F            ld l, a
      26 40         ld h, 40
4113  4E            ld c, (hl)
      23            inc hl
      46            ld b, (hl)
      79            ld a, c
      ED 5B 45 40   ld de, (4045)
      BB            cp e
      28 03         jr z, 03
      83            add e
      28 DB         jr z, DB
      E1            pop hl
      09            add hl, bc
      7E            ld a, hl
      FE 08         cp 08
```

(listing 2 continued on page 147)

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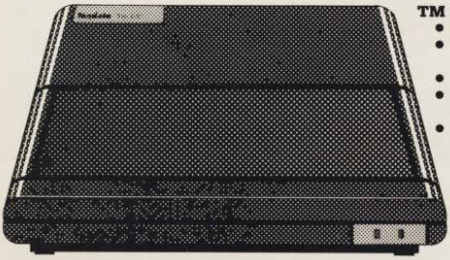

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(listing 2 continued from page 145)

```
        28 C2     jr z, C2
        FE 76     cp 76
        28 26     jr z, 26
        FE 8B     cp 8B
        28 22     jr z, 22
        FE 06     cp 06
        28 1E     jr z, 1E
        FE B2     cp B2
        28 67     jr z, 67
4138    32 47 40  ld (4047), a
        36 8B     ld (hl), 8B
        22 43 40  ld (4043), hl
        ED 43 4F 40  ld (404F), bc
        3A 52 40  ld a, (4052)
        C6 05     add 05
        32 52 40  ld (4052), a
        FE 52     cp 52
        20 81     jr nz, 81
        18 09     jr 09
        ED 42     sbc hl, bc
        01 00 00  ld bc, 0000
        3E 00     ld a, 00
        18 E0     jr, E0
        2A 3C 40  ld hl, (403C)
        36 B2     ld (Hl), B2
        CD BB 02  call 02BB
        7D        ld a, l
        2F        cp l
        6F        ld l, a
        E6 81     and 81
        28 05     jr z, 05
416A    11 0E 00  ld de, 000E
        18 1D     jr 1D
        7D        ld x, l
        E6 18     and 18
        28 05     jr z, 05
        11 F2 FF  ld de, FFF2
        18 13     jr 13
        7D        ld a, l
        E6 60     and 60
        28 05     jr z, 05
        11 01 00  ld de, 0001
        18 09     jr 09
        7D        ld a, l
        E6 06     and 06
        CA BB 40  jp z, 40BB
        11 FF FF  ld de, FFFF
        2A 3C 40  ld hl, (403C)
        36 00     ld (hl), 00
        19        add hl, de
        7E        ld a, (hl)
        06 00     ld b, 00
        FE 08     cp 08
        28 32     jr z, 32
        FE 76     cp 76
        28 32     jr z, 32
        FE 8B     cp 8B
        CA D5 42  jp z, 42D5
        FE 0D     cp 0D
        28 38     jr 38
        FE 17     cp 17
        20 02     jr nz, 02
        06 01     ld b, 01
        FE AB     cp AB
        20 02     jr nz, 02
        06 0A     ld b, 0A
        FE 06     cp 06
        20 09     jr nz, 09
        E5        push hl
        21 56 40  ld hl, 4056
        CB 86     res 0, (hl)
        E1        pop hl
        06 14     ld b, 14
        78        ld a, b
        A7        and a
        20 2E     jr nz, 2E
        36 B2     ld (hl), B2
        22 3C 40  ld (403C), hl
        C3 0F 42  jp 420F
        ED 52     sbc hl, de
        18 F4     jr F4
        7B        ld a, e
        FE 01     cp 01
        28 05     jr z, 05
        11 0D 00  ld de, 000D
        18 B8     jr, B8
        11 F3 FF  ld de, FFF3
        18 B3     jr B3
        3E 06     ld a, 06
41E0    32 3C 41  ld (413C)
        3E 1A     ld a, 1A
        32 37 41  ld (4137), a
        01 00 00  ld bc, 0000
        ED 43 56 40  ld (4056), bc
        06 05     ld b, 05
        E5        push hl
        2A 0C 40  ld hl, (400C)
        11 4F 01  ld de, 014F
        19        add hl, de
        7E        ld a, (hl)
        FE 1B     cp 1B
        20 01     jr nz, 01
        3C        inc a
        3C        inc a
        FE 26     cp 26
        20 05     jr nz, 05
        36 1C     ld (hl), 1C
        2B        dec hl
        18 F0     jr F0
        77        ld (hl), a
        10 E6     djnz, E6
        E1        pop hl
        18 B4     jr B4
        21 56 40  ld hl, 4056
        CB 76     bit 6, (hl)
4214    CA 5D 42  jp z, 425D
        3A 3C 41  ld a, (413C)
        FE 06     cp 06
        C2 5D 42  jp nz, 425D
        3E 8B     ld a, 8B
        32 3C 41  ld (413C), A
4224    3E 67     ld a, 67
        32 37 41  ld (4137), A
        2A 3E 40  ld hl, (403E)
        3A 42 40  ld a, (4042)
        77        ld (hl), A
        2A 43 40  ld hl, (4043)
        3A 47 40  ld a, (4047)
        77        ld (hl), a
        2A 4B 40  ld hl, (404B)
        3A 4C 40  ld a, (404C)
        77        ld (hl), a
        2A 4D 40  ld hl, (404D)
        3A 51 40  ld a, (4051)
        77        ld (hl), a
        3E 00     ld a, 00
        32 42 40  ld (4042), a
        32 47 40  ld (4047), a
        32 4C 40  ld (404C), a
        32 51 40  ld (4051), a
        2A 0C 40  ld hl, (400C)
        11 3F 00  ld de, 003F
4259    19        add hl, de
        C3 9E 40  jp 409E
        21 56 40  ld hl, 4056
        CB 76     bit 6, (hl)
        28 36     jr z, 36
        2A 51 40  ld hl, (4053)
        7E        ld a, (hl)
        FE 8B     cp 8B
        28 2E     jr z, 2E
        FE B2     cp B2
        28 2A     jr z, 2A
        36 00     ld (hl), 00
        2A 32 40  ld hl, (4032)
        7C        ld a, h
        E6 1F     and 1F
        FE 1F     cp 1F
        20 1E     jr nz, 1E
        3A 55 40  ld a, (4055)
        CB 57     bit 2, A
        20 17     jr nz, 17
        3C        inc a
        32 55 40  ld (4055), a
4287    CB 7C     bit 7, h
        28 04     jr z, 04
        3E AB     ld a, AB
        18 02     jr 02
        3E 0D     ld a, 0D
        2A 53 40  ld hl, (4053)
        77        ld (hl), a
        21 56 40  ld hl, 4056
        36 00     ld (hl), 00
        2A 0C 40  ld hl, (400C)
        01 33 01  ld bc, 0133
        3E 17     ld a, 17
        ED B1     cpir
        28 1C     jr z, 1C
        21 3E 40  ld hl, 403E
        11 04 00  ld de, 0004
42AC    42        ld b, d
        4B        ld c, e
        19        add h, de
        ED A1     cpi
        28 0F     jr z, 0F
        EA AE 42  jp pe, 42AE
        2A 0C 40  ld hl, (400C)
        01 33 01  ld bc, 0133
        CD C5 42  call 42C5
        C3 8A 40  jp 408A
        C3 BB 40  jp 40BB
        ED A1     cpi
        E0        ret po
        7E        ld a, (hl)
        FE 08     cp 08
        28 F8     jr z, F8
        FE 76     cp 76
        28 F4     jr z, F4
        36 17     ld (hl), 17
        18 F0     jr F0
        06 12     ld b, 12
        2A 0C 40  ld hl, (400C)
        23        inc hl
        7E        ld a, (hl)
        FE 76     cp 76
        28 FA     jr z, FA
        FE 38     cp 38
        28 05     jr z, 05
42E4    C6 80     add a, 80
        77        ld (hl), a
        18 F1     jr, F1
        11 00 06  ld de, 0600
        1B        dec de
        7A        ld a, d
        B3        or e
        20 FB     jr nz, FB
        10 E4     djnz, E4
        2A 0C 40  ld hl, (400C)
        01 33 01  ld bc, 0133
        3E B2     ld a, B2
        ED B1     cpir
        20 03     jr nz, 03
        2B        dec hl
        36 8B     ld (hl), 8B
        CD BB 02  call 02BB
        44        ld b, h
        4D        ld c, l
        51        ld d, c
        14        inc d
        28 F7     jr z, F7
4308    2A 0C 40  ld hl, (400C)
        11 4F 01  ld de, 014F
        19        add hl, de
        06 08     ld b, 08
        23        inc hl
        36 1B     ld (hl), 1B
        10 FB     djnz, FB
        C3 B6 42  jp 42B6
        E1        pop hl
        7E        ld a, (hl)
        23        inc hl
        E5        push hl
        FE FF     cp FF
        C8        ret z
        CD 08 08  call 0808
        18 F4     jr F4
4328    FD 36 22 00  ld (iy+22), 00
        CD 1C 43  call 431C
432F    08 08 08 08 08 08 08 08 08 08 08 08 76
        08 17 17 17 17 17 08 17 17 17 17 17 08 76
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        38 28 34 37 2A 1B 1B 1B 1B 1B 1B 1B 1C 76
        FF
        C3 02 43  jp 4302
```

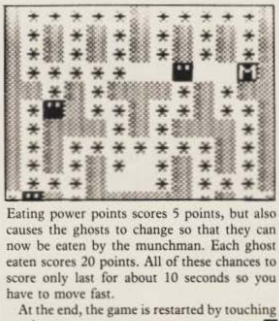
(continued from page 145)

The actual game is started by pressing any key. The munchman appears on the screen as an inverse M. He is steered around the maze by the method first shown in Toni Baker's *Mastering Machine Code on the ZX-81*. The top line of keys moves him up, the bottom line moves him down, and the two middle lines are split so that the left hand half moves him left and the right hand half moves him right.

Collision with a ghost means instant death. The munchman's only advantage is his speed and his ability to go through the tunnel.

One point is scored for each star eaten. Clearing a screen will result in it being filled again.

Four times during each screen either fruit, represented by an inverse F, or a power point, represented by a $ will appear underneath the ghosts' nest. Eating fruit scores 10 points.



Eating power points scores 5 points, but also causes the ghosts to change so that they can now be eaten by the munchman. Each ghost eaten scores 20 points. All of these chances to score only last for about 10 seconds so you have to move fast.

At the end, the game is restarted by touching any key. ■

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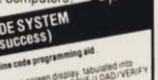

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SINCLAIR USER FEBRUARY 1983

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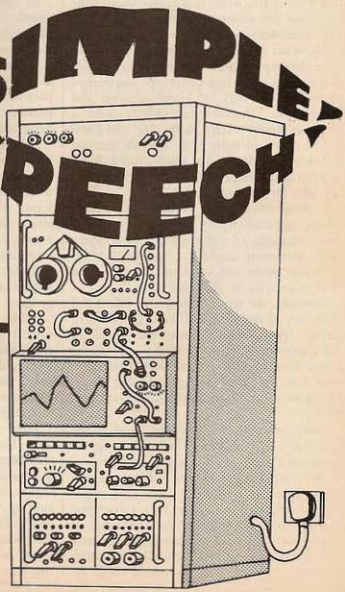

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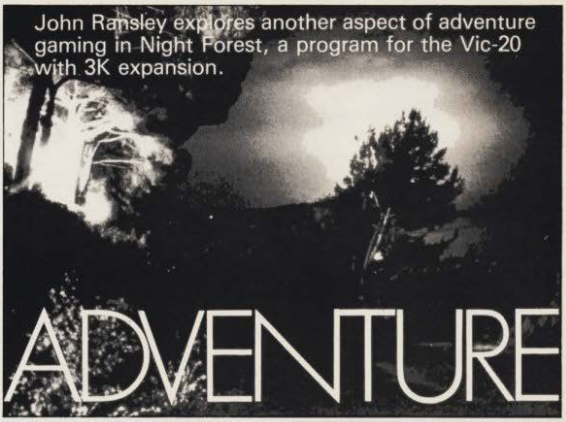
John Ransley explores another aspect of adventure gaming in Night Forest, a program for the Vic-20 with 3K expansion.



THE LEAST SOPHISTICATED form of adventure is the compass and grid game featured in the first article in this series — *Your Computer*, September 1983 — which makes use of a fixed playing area represented by a two-dimensional array and upon which various obstacles, challenges, landmarks and other features are sited.

Usually, their positions on the grid do not change during the course of any one run and, as the player is usually provided with a map, play becomes fairly predictable after a little familiarity is gained. With the C and G adventure, the program structure, therefore, does not commonly allow for more than one fixed response per encounter; meet a monster and he always kills you, or land on a certain co-ordinate and you will always be at the mouth of the same cave.

You can, of course, introduce one or two randomisers to provide at least a little variation in the seeding of features, such as the location of the treasure to be discovered, but even so, more elaborate development is rather restricted. Nevertheless, devising compass and grid games is always a good exercise in writing tidy Basic — and it is of particular value when it comes to gaining experience in assembling useful and legible screen displays.

With many software authors the appearance of instruction and other mainly text pages seems to merit less creative attention than the design of cloakroom tickets — whereas they are quite happy to spend hours Poking pixels to improve the looks of a dismembered galaxian. When you remember how many times you and others will be confronted by the text screens you write, it is surely worthwhile to devote just a little time making them neat and readable.

So, what should you watch for? First, screens comprising more than a short line or two of text usually look better, and can be read more easily, if they are keyed in upper and lower case. Alternatively, if you have a generous dollop of RAM to play with, you might prefer to copy your micro's existing ROM-based alphabet and digits onto a chunk of protected memory and then redefine them specially for optimum readability.

Flicking through the pages of the weekly colour supplements, for example, will provide you with plenty of typographic inspiration for your electronic alphabet, as the ads in particular make use of attractive and often novel typestyles for their text copy.

Secondly, do not overlook the value and flexibility of the SPC and TAB functions in screen layout, and always use them in preference to the Cursor Right and Cursor Down keys when you want to relocate more than two or three screen positions away. Doing so will save bytes as well as keyboard wear.

Next, remember to make the most of the role that colour can play in improving the appearance and player comprehension of screen displays — and in adding to the atmosphere.

For example, an encounter with a dyspeptic dragon might be appropriately declared in white lettering against a flame-red background — whereas the gloom of a subterranean romp through the troll caverns could best be reflected in a text display of yellow or cyan on black. Finally, bear in mind always that adventure programs rely heavily for their correct operation on the careful siting of Get and Input statements.

Every incidence of their use must be carefully thought through if you are not to end up at the wrong end of the aforesaid dragon's firepower when you really expected to be home and dry with the loot and/or damsel in distress.

In this connection, keyboard responses benefit from some form of audible confirmation and it should be an easy matter to weave in a blip subroutine to provide this.

In the case of any Get, it is always advisable to add a mug trap so that control will loop back to the initiating line not only if no key is pressed but also is any but one of the designated keys is pressed.

Still on the subject of Get statements, it is worth sounding a warning bell about one potential — and invisible — bug that can arise whenever Get or Input does *not* follow a screen display and thus effectively freeze the screen. In such instances, you must introduce a delay loop so that the text remains on view long enough to be read.

If you fail to do so, all you will see is a momentary change of screen before the program speeds on to the next instruction.

Before leaving what can be the fascinating subject of screen presentation and associated commands, a word or two about the Great Text versus Text and Graphics Debate. For years, games players suckled on Scott Adams adventures were quite content with nothing more than words.

Then along came Melbourne House and The Hobbit, with its 40K of ingenuity incorporating no fewer than 30 graphically illustrated locations. However, purists might argue that the whole point of adventure gaming is that it allows the player's imagination to ride at full tilt. Indeed, the American software house Infocom, publishers of the near-classics Zork and Deadline, makes that case rather well in its advertising:

Variables.

DL	Difficulty level
B	Bullets
LN	Location North
LS	Location South
LE	Location East
LW	Location West
ES	Event selection
S	Strength of torch battery
TL	Time loop
RS	Response

We draw our graphics from the limitless imagery of your imagination — a technology so powerful, it makes any picture that's ever come out of a screen look like graffiti by comparison.

Be that as it may, it is also interesting to note that even Scott Adams is now beginning to market new graphics-enhanced versions of Adventureland, The Count and other famous titles which started life when an inverse CHR$(32) was about all you could move around the screen.

In any event, and even if you do have the spare RAM and the imagination and aptitude to generate dazzling graphics, the secret is probably not to overdo it. Waiting for a high resolution screen to build every other move comes second in the boredom stakes to watching paint dry.

The overall program structure for an option-menu style of adventure — of which The Night Forest is a modest example — is fairly easy to grasp and adapt. The listing shown will run on a Vic-20 plus 3K expansion but — the title screen, jingle and blip routines apart — the program is easily portable to other Basic dialects.

Think of the program as a group of almost self-contained modules. One is there to create the playing area, one to invite and implement each move, and others pose encounters or risks and then report the outcome. There are smaller modules to check the players' current position and other parameters.

In fact, elegantly structured it is not — yet this is part of the charm of option-style adventures, as they allow for plenty of

boilerplating — the amending or substitution of complete modules as other play variations and fiendish events come to the author's mind. It is even possible to add entirely new modules by simply updating only the ES logic and using a Goto that passes control to the risk and result elements of an existing module.

A walk through The Night Forest's listing, while referring to the guide notes which follow, should help you to understand how it all comes together and to start writing your own menu-option style adventure.

You had better keep it simple to start with. Once you have the experience of constructing an original program that runs the way it should, you can then bolt on extra modules, graphics and sound effects.

In The Night Forest, lines 120-138 make a start by Poking 100 club symbols — trees, actually! — into random locations and colouring them green. Lines 150-195 set up the instructions option, and the first mug trap occurs in the last of these, looping control back to 170 if any but key Y or N is touched. On this screen page, as elsewhere, information lines appear in white and response demands in yellow — both against a black background.

The difficulty level is set in lines 200-230, where 20, 35 or 50 move limits are awarded to the variable DL for the hard, medium and easy options respectively. You may alter one or more of these figures to vary the overall or respective difficulty of the different options.

The player's starting position on the invisible playing grid, which is 50 elements square, is given in lines 240-310, together with other variables. Line 270 sets the number of bullets at three — you can increase this number but remember to amend the text in line 14080 too — and gives a value to S — representing torch battery strength — which may be lowered to make for a tougher game.

After 310, control branches off to the subroutine beginning in line 3000, which first deducts two points from the S variable on each turn, while 3010-3070 set up the move prompt display and update the player's grid position accordingly.

If the player reaches zero point on the North, South, East or West boundaries — or comes near to doing so — his success is reported by lines 3500-3501 or 3200-3201 respectively. Meanwhile, lines 3032-3035 subtract one from DL on each move and end the game if DL zeros. Line 3100 serves the same purpose in checking the remaining battery strength.

If the result is negative in either case, control passes to the repeat play option beginning with line 3510. If the response is positive, the variables are reset and the program Runs again while bypassing the initial screen display and jingle — which can get monotonous.

If none of these conditions are met, control passes back to line 330, which randomly selects one of several events. The first encounter is with a basket of food, where a risk is set by line 430 and implemented by 442. Another challenge arrives in line 460, with four options. In this module, the results of the other options take into account the player's current strength rating and update complementary variables. Shooting at the axeman decreases the number of bullets left by triggering line 590.

Line 660 presents a poisonous snake from which you may or may not escape safely according to line 715, which also decides the outcome of the bear trap encountered in line 700. The pond module starting at line 810 also presents another hazard to your torch battery strength, which is halved if control passes to 890.

Whenever a number or letter key is touched, or if the space bar is pressed, the subroutine in lines 9000-9030 sounds a blip. Likewise, the ominous jingle is heard when something nasty is about to happen to you, courtesy of lines 8000-8090. Lines 12000-16095 are the instruction pages, which can be omitted — but remember to lose lines 150-190 and amend line 195 to Goto 200. ■

```
.00 REM THE NIGHT FOREST
110 REM (PRINT AT 18) TOMY PRINTER
120 PRINTCHR$ 14; "Z" POKE 36879,5
134 FOR L=1TO100
135 PRINT POKE 7680+L,5*RND(1)+1
136 POKE7680+L,80 POKE38400+L,5
137 FORB=1TO20:NEXTB:NEXTL
138 PRINTSPC(20);"THE NIGHT FOREST"
140 GOSUB9010
150 PRINT"[3]REQ YOU REQUIRE GAME"
160 PRINT"[3]REQ YOU INSTRUCTIONS"
166 PRINT PRINT"[8]PRESS <Y> OR <N>"
170 GETR$:IFR$="Y"THEN195
180 IFR$="Y"THEN60GOSUB9010:GOSUB12000:GOTO200
190 IFR$="N"THEN60GOSUB9010:GOTO200
195 GOTO170
200 PRINTCHR$(14);"[3]LEVEL OF DIFFICULTY:" PRINT
PRINTSPC(5);"1. HARD"
205 PRINTSPC(7);"2. EDIUM" PRINTSPC(7);"3. EASY"
PRINT PRINT"[3]LEVEL ";:I=0:R$=""
206 GETR$:IFR$=""THEN206
210 GOSUB9010:IFR$="1"THENDL=20:GOTO240
225 IFR$="2"THENDL=35:GOTO240
235 IFR$="3"THENDL=50:GOTO240
235 GOTO206
235 REM LOCATION
240 XS=INT(RND(1)*40)+10
250 LS=50-LX:
260 LX=INT(RND(1)*40)+10
270 LHW=50-LX:B=3:S=50
310 GOSUB3000
320 S=75
325 REM EVENTS
330 ES=INT(RND(1)*20)+1
340 IFES=1THEN400
350 IFES=2THEN450
360 IFES=3THEN500
370 IFES=4THEN810
380 IFES=5THEN660
380 GOTO330
400 PRINT"[3]DO FIND A BASKET OF"
404 PRINT"EATABLE FISHING FOOD." PRINT
405 PRINT"[3]DO EAT ANY OF IT?" PRINT
406 PRINT"[3]DO ARE ERY THIRSTY"
410 GETR$:IFR$=""THEN410
412 IFR$="Y"THEN60GOSUB9010:GOTO310
420 IFR$="Y"THEN60GOSUB9010
430 RISK=INT(RND(1)*3)+1 IFRISK=1THEN442
440 GOTO310
442 PRINT PRINT"[3]DO FALL ASLEEP FOR"
444 PRINT"[3]HOUR. LEAVING YOUR"
450 PRINT"TORCH RUNNING DOWN." GOSUB10000 S=S-(DL.5)
GOTO310
455 REM CHASE
460 IFES=3THEN660
470 IFES=3THENPRINT"[3]DO CRACED SCREAM CUTS"
481 PRINT"THROUGH THE NIGHT AIR."
482 PRINT"[3]DO AND AXEMAN CHARGES"
483 PRINT"[3]STRAIGHT AT YOU." PRINT
484 PRINT"OILL YOU" PRINT
465 PRINTSPC(2);"[3]N LIKE HELL"" PRINTSPC(2);"2.
-IGE OFF A SHOT"
466 PRINTSPC(2);"3. -IND A HIDING  PLACE"
469 PRINTSPC(2);"4. [3]B WITH SCREA-  DRIVER" PRINT
469 PRINT"[3]L [8]"
470 GETR$:IFR$=""THEN470
480 IFR$="1"THEN500
481 IFR$="2"THEN560
482 IFR$="3"THEN620
485 GOTO470
500 GOSUB9010 IFS<0THENPRINT"[3]HE AXEMAN HAS CAUGHT
YOU! OHAT NEXT?" PRINT GOTO465
501 IFS<21THENPRINT"[3]E HAS CAUGHT YOU.[3]WHAT
HAPPENS NEXT?
502 PRINT"WILL COME AS A VERY"
503 PRINT"NASTY BLOW." GOSUB10000
505 GOSUB9010 PRINT PRINT"[3]DO HAVE PERISHED.
" PRINT GOTO3510
520 RISK=INT(RND(1)*3)+1
530 S=S-10
540 IFRISK=1THENPRINT"[3]DO HAVE WRANGED"
541 PRINT"TO EVADE THE AXEMAN." GOSUB18000 GOTO3010
550 PRINT"E HAS CAUGHT YOU!"
555 IFS<70THEN505
560 DL=DL-1
565 PRINT PRINT"[3]OW WHAT YOU DO?" PRINT GOTO465
580 GOSUB9010 PRINT PRINT"[3]DO HAVE FIRED"
" GOSUB10000
590 B=B-1
595 IFB<0THENPRINT"[3]DO RE OUT OF BULLETS." GOTO505
600 RISK=INT(RND(1)*3)+1 IFRISK=2THEN610
605 GOTO611
610 PRINT PRINT"[3]DO HAVE KILLED HIM." GOSUB10000
GOTO310
611 S=S-10 PRINT PRINT"[3]OUT YOU HE MISSED!"
GOSUB10000 PRINT GOTO505
620 GOSUB9010 PRINT PRINT"[3]HE AXEMAN WARTS...
RNOWNTS." GOSUB10000
623 RISK=INT(RND(1)*4)+1
622 IFRISK=1THEN505
640 PRINT PRINT"...BUT AT LAST LEAVES." GOSUB10000
GOTO310
650 GOTO610
660 PRINT"[3]DO HAVE BEEN BITTEN"
661 PRINT"[3]N A POISONOUS SNAKE."
662 GOSUB18000 GOTO715
690 REM TRAP
700 PRINT"[3]DO STEP INTO A BEAR"
701 PRINT"TRAP. OILL YOU" PRINT
702 PRINTSPC(2);"1. ORIT FOR HELP"
703 PRINTSPC(2);"2. RY TO PULL OPEN"
704 PRINTSPC(4);"[3]TRAP WITH ROPE"
705 PRINT PRINT"[3]L [8]"
710 GETR$:IFR$=""THEN710
712 IFR$="1"THEN60GOSUB9010:GOTO730
715 RISK=INT(RND(1)*3)+1 IFRISK=1THEN505
716 PRINT PRINT"[3]DO ESCAPE SAFELY." GOSUB10000
S=S-10 GOTO310
720 RISK=INT(RND(1)*4)+1
722 IFRISK=1THEN60GOSUB9010 PRINT PRINT"[3]DO. IIE OF
-"WOUNDING." GOTO5510
730 PRINT PRINT"[3]ELP DOES NOT COME."
731 PRINTSPC(2);"OILL YOU" PRINT
732 PRINT PRINT"[3]L [8]"
740 GETR$:IFR$=""THEN60GOSUB9010 GOTO715
741 IFR$="N"THEN60GOSUB9010 GOTO505
742 GOTO740
745 GOSUB9010 GOTO740
800 -816
805 REM POND
810 PRINT"[3]DO AL. COME TO A POND."
811 PRINT"[3]DO ARE ERY THIRSTY."
812 PRINT PRINT"OILL YOU" PRINT
813 PRINTSPC(2);"1. DRINK THE WATER"
814 PRINT"RE. (HINT: ABOUT WHAT"
815 PRINTSPC(2);"2. DRINK MIGHT BE"
816 PRINT"RE. IGNORE THE WATER" PRINT
818 PRINT"[8]"
820 GETR$:IFR$="1"THEN820
825 IFR$="1"THEN60GOSUB9010 GOTO830
826 IFR$="2"THEN60GOSUB9010 GOTO840
827 GOTO890
830 RISK=INT(RND(1)*3)+1 IFRISK=1THENPRINT PRINT
"[3]E WATER S PUR.IFIED."  GOTO505
840 GOSUB9010 PRINT PRINT"[3]HE WATER IS PURE."
841 PRINT"BL. THIS TIME." GOSUB18000 S=S+(DL*3)/10
850 PRINT PRINT"[3]O BUSY THINKING  YOU"
861 PRINT"HAVE JUST DROPPED THE"
862 PRINT"TORCH INTO THE POND." GOSUB18000 S=S-5
GOTO310
890 S=S-2: GOTO310
1295 REM MOVE MODULE
3000 S=S-2:
3010 PRINT"[3]N WHICH DIRECTION" PRINT"DO YOU CHOOSE
TO GO?" PRINT
3015 PRINTSPC(6);"1. ORTH" PRINTSPC(6);"2. OUTH"
3020 PRINTSPC(6);"3. EST" PRINTSPC(6);"4. EST" PRINT
3025 PRINT"[3]L [8]"
3030 GETR$ IFR$="1"THEN3070
3032 DL=DL-1
3035 GOSUB9010 IFDL=0THENPRINT"[3]DO ARE OUT OF MOVES.
" PRINT GOSUB18000 GOTO3510
3040 IFR$="1"THENLHW=LHW-1:LS=LS+1 GOTO3080
3050 IFR$="2"THENLHW=LHW+1:LS=LS-1 GOTO3080
3060 IFR$="3"THENLX=LX-1:LX=LX+1 GOTO3080
3070 IFR$="4"THENLX=LX+1:LX=LX-1 GOTO3080
3075 GOTO3030
3080 IFLHW>80ORLX>80ORLS>80THEN3500
3100 IFS<1THENPRINT"[3]OUR TORCH BATTERY HAS RUN DOWN
GOSUB18000 GOTO3510
3105 IFLHW>30ORLX>30ORLS>0THEN3200
3110 RETURN
3200 PRINT"[3]OU ARE JUST A FEW"
3201 PRINT"MS FROM HOME." GOSUB10000 RETURN
3500 PRINT"[3]ONGRATULATIONS! YOU"
3501 PRINT"HAVE REACHED SAFETY." PRINT
3510 PRINTCHR$(14);"[8]OULD YOU LIKE TO"
3511 PRINT"PLAY ANOTHER GAME"
3512 PRINT PRINT"[3]L [8]"
3514 GETR$:IFR$=""THEN3514
3515 IFR$="Y"THEN60GOSUB9010 GOTO150
3516 IFR$="N"THEN60GOSUB9010 GOTO3530
3520 GOTO3514
3530 PRINT"[3]HANK YOU FOR THE"
3540 PRINT"A WALK THROUGH [8]HE"
3550 PRINT"-IGHT -OREST WITH ME." PRINT PRINT"OODBYE
FOR NOW." END
8000 REM JINGLE
8010 POKE36875,15
8020 READN IFN=1THEN8070
8030 READD POKE36876,N POKE36875,N FORT=1TOD NEXT
GOTO8020
8070 POKE36875,0 POKE36875,0 POKE36876,0 RESTORE
RETURN
9000 DATA 195 300 209 400 217 200 215 200 217 200 215
200 209 400 217 200 215 400
9090 DATA 217 200 209 200 215 200 217 200 215 400
217 200 209 400 1
9000 REM BLIP
9010 POKE36875,15 POKE36876,220
9020 FOR=1TO50 NEXTB
9030 POKE36875,0 POKE36876,0 RETURN
12000 PRINT"[3]OU ARE ERY -ITE"
12010 PRINT PRINT
12020 PRINTCHR$(14);"[8]HILE ON A MOTORING"
12030 PRINT "TOUR OF FLD #RGHY"
12040 PRINT"YOUR CAR BREAKS DOWN"
12050 PRINT"AND YOU START WALKING"
12060 PRINT"TO FIND HELP. #ON YOU"
12070 PRINT"REALISE THAT THE ROAD"
12080 PRINT"COMES TO A DEAD END"
12090 PRINT"A LITTLE WAY INTO A "
13000 PRINT"FOREST."
13010 PRINT
13020 PRINT"T IS GROWING DARK."
13030 PRINT" DU WALK BACK TO YOUR"
13040 PRINT"CAR BUT IT SEEMS USE-"
13050 PRINT"LESS TO STAY THERE."
13060 PRINT"[3]L [8]"
13070 GETR$ IFR$=""THEN13070
13080 IFR$=CHR$(32)THEN60GOSUB9010 GOTO13090
13085 GOTO13070
13090 PRINT"[3]U RUN AWA SHOWS THAT"
14000 PRINT"YOU ARE LONELIED TO"
14010 PRINT"GO THROUGH THE FOREST "
14020 PRINT"WHICH COVERS AN AREA"
14030 PRINT"OF SOME 50 SQ KMS."
14050 PRINT" DU TAKE FROM YOUR CAR"
14060 PRINT"A TORCH SCREWDRIVER"
14070 PRINT"TOW-ROPE AND PISTOL."
14080 PRINT"WITH JUST 3 BULLETS."
14090 PRINT
15000 PRINT" DU CAN MOVE JUST 1 AW"
15010 PRINT" ORTH #OUTH "AST OR-"
15020 PRINT"EST FROM THE PRESENT PLA-"
15030 PRINT"CHOICES AS THEY ARE"
15040 PRINT"OFFERED TO YOU."
15050 PRINT
15000 PRINT
15090 PRINT"[3]L [8]"
16000 GETR$ IFR$=""THEN16000
16005 IFR$="Y"THEN60GOSUB9010 GOTO16010
16006 GOTO16000
16010 PRINT"[3]HE TORCH GROWS DIMMER"
16015 PRINT"WITH EVERY MISTAKE."
16020 PRINT"YOU MAKE. F ITS BEAM"
16025 PRINT"DIES BEFORE YOU FIND A"
16030 PRINT"SAFE PLACE TO STAY."
16035 PRINT"WILL GO OUT LIKE A"
16040 PRINT"LAMP. IGHT AT DAWN"
16045 PRINT"WILL PROLONG THE TORCH"
16050 PRINT"LIFE AND YOUR OWN!"
16055 PRINT
16060 PRINT" DU WILL GET A CLUE"
16065 PRINT"WHEN YOU HEAR SAFETY."
16070 PRINT
16075 PRINT"[3]L [8]"
16080 GETR$ IFR$=""THEN16080
16090 IFR$=CHR$(32) THEN60GOSUB9010 GOTO160
16095 GOTO16080
16000 FORL=1TO4000 NEXT RETURN
```

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TAPE VERIFY

ORIC

Bob Green details a method of verifying a program on tape for the Oric-1 using a machine-code routine.

ONE THING THAT the Oric-1 does not have in its command table is some way of verifying a program on tape once it has been Saved. This is a great pity because probably one of the biggest single causes of heartache among home computer enthusiasts is tape Loading/Saving problems. Due to the many variations and permutations of machines and cassette recorders, it would be vain of any manufacturer to presume that his tape routines were perfect. The Microtan 65 system has an Exam — verify — facility.

A verify procedure in machine code is fairly simple as the only requirement really is to do a comparison of the bytes on the tape with what should be the same bytes residing in memory. Decisions then have to be taken by the routine should a mismatch occur but once this basic method is established, then a very reliable utility results.

It would be fair to point out at this stage that the author cannot take all the credit for this program because many of its routines are from within Oric's operating system. However, this makes me ask the question, "Why was it not included in the first place?". Astute machine code freaks among you may note that only about four instructions of one part of the routine had to be changed in order to achieve the desired comparison of bytes.

The program is fully self-contained and contains its own prompts/error messages etc. By courtesy of Kenema's excellent Exmon program, a full disassembled object code listing is reproduced for those who wish to study the intricacies of the program. The Basic loader should satisfy most people's tastes and is self-checking and self-operating when Run.

The use of the program is very simple due solely to the excellent extension command facility that is a feature of Oric Basic. Simply consult Chapter 11 of your manual and follow the same syntax that you have always used for the cassette commands. The only change is to substitute a "!" for the command word and all will perform in the same way except that the program will simply compare bytes and then inform you whether the verification was successful or not.

An audio indication has been included just in case you are out of the room during a long program check. Machine code users should note at this stage that if they are copying the hex coding then they should activate the new command by Doke #2F5,#9700. This is done automatically by the Basic loader. Himem #9700 should also be entered to protect the program from Basic. Once loaded, it may be Saved by:

CSAVE "VERIFY",A#9700,E#97FE
(or at slow speed if desired)

Now you may go through the wierd procedure of a verify program checking itself with "VERIFY"!!

Should it be required, the program is easily relocated as long as the two absolute instructions at #970C and #9720 are borne in mind.

```
9700 A59C   LDA $9C
9702 A49D   LDY $9D
9704 8500   STA $00
9706 8401   STY $01
9708 08     PHP
9709 2025E7 JSR $E725
970C 20CAE6 JSR $E6CA
970F 202397 JSR $9723
9712 2004EB JSR $EB04
9715 28     PLP
9716 A600   LDX $00
9718 A501   LDA $01
971A B59D   STA $9D
971C B69C   STX $9C
971E 68     PLA
971F 68     PLA
9720 4CCB97 JMP $97CB
9723 2063E5 JSR $E563
9726 A903   LDA #$03
9728 A0E5   LDY #$E5
972A 2076E5 JSR $E576
972D 2096E6 JSR $E696
9730 2030E6 JSR $E630
9733 C924   CMP #$24
9735 D0F9   BNE $9730
9737 A209   LDX #$09
9739 2030E6 JSR $E630
973C 955D   STA $5D,X
973E CA     DEX
973F D0FB   BNE $9739
9741 2030E6 JSR $E630
9744 F005   BEQ $974B
9746 9549   STA $49,X
974B EB     INX
9749 D0F6   BNE $9741
974B 9549   STA $49,X
974D 20F0E6 JSR $E6F0
9750 8A     TXA
9751 D0D0   BNE $9723
9753 2063E5 JSR $E563
9756 A9?2   LDA #$92
9758 A097   LDY #$97
975A 2076E5 JSR $E576
975D 206EE5 JSR $E56E
9760 A55F   LDA $5F
9762 A460   LDY $60
9764 8533   STA $33
9766 8434   STY $34
9768 A000   LDY #$00
976A 2030E6 JSR $E630
976D B00A   BCS $9779
976F D133   CMP ($33),Y
9771 D006   BNE $9779
9773 2054E5 JSR $E554
9776 90F2   BCC $976A
9778 60     RTS
9779 2063E5 JSR $E563
977C 2019C7 JSR $C719
977F 2004EB JSR $EB04
9782 209FCB JSR $CB9F
9785 A9A1   LDA #$A1
9787 A097   LDY #$97
9789 20EDCB JSR $CBED
978C 209BFA JSR $FA9B
978F 4CB5C4 JMP $C4B5
```

```
9792 10 07 56 65 72 69 66 79 ..Verify
979A 69 6E 67 20 2E 00 0D ing ....
97A2 0A 54 41 50 45 20 45 52 .TAPE ER
97AA 52 4F 52 20 2E 2E 2E 0D ROR ....
97B2 0A 56 65 72 69 66 69 63 .Verific
97BA 61 74 69 6F 6E 20 61 62 ation ab
97C2 6F 72 74 65 64 2E 0D 0A orted...
97CA 00 .
97CB A9DB   LDA #$DB
97CD A097   LDY #$97
97CF 20EDCB JSR $CBED
97D2 20B5FA JSR $FAB5
97D5 4C6BC9 JMP $C96B
97D8 0D 0A 54 41 50 45 20 26 ..TAPE &
97E0 20 4D 45 4D 4F 52 59 20  MEMORY
97E8 4D 41 54 43 48 2E 0D 0A MATCH...
97F0 56 65 72 69 66 69 65 64 Verified
97F8 20 4F 4B 2E 0D 0A 00  OK....
```

```
10 REM ### "VERIFY" BASIC LOADER ###
15 REM First protect program from BASIC & zero checksum variable
20 HIMEM#9700:J=0
25 REM Now set up loop for start and end addresses of program.
30 FOR I=#9700 TO #97FE
35 REM Get a byte
40 READ D
45 REM Shuv' it in ! (and update #sum)
50 POKE I,D:J=J+D
55 REM Keep going till we've finished
60 NEXT
61 REM Now check the checksum !!
62 IF J=26977 THEN PRINT"All loaded OK.":PRINT:GOTO70
63 PRINT"There's a byte wrong in your DATA     lines somewhere !
64 PRINT"Check it against the LISTING then try it again !!":PRINT:END
65 REM Now we've finished, set up the ORIC "!" command to suit.
70 DOKE #2F5,#9700
75 REM Now use "!" just as you would use CLOAD or CSAVE except that
76 REM the program you wish to verify must be in memory before you
77 REM check the TAPE against it. Any messages used by the program
78 REM are self contained. Remember that the SYNTAX of use is
79 REM exactly the same as the normal cassette routines. (M/C also)
80 END
90 DATA165,156,164,157,133,0,132,1,8,32,37,231,32,202,230,32,35,151,32,4,232
100 DATA40,166,0,165,1,133,157,134,156,104,104,76,203,151,32,99,229,169,3,160
110 DATA229,32,118,229,32,150,230,32,48,230,201,36,208,249,162,9,32,48,230,149
120 DATA93,202,208,248,32,48,230,240,5,149,73,232,208,246,149,73,32,240,230
130 DATA138,208,208,32,99,229,169,146,160,151,32,118,229,32,110,229,165,95,164
140 DATA96,133,51,132,52,160,0,32,48,230,176,10,209,51,208,6,32,84,229,144,242
150 DATA96,32,99,229,32,25,199,32,4,232,32,159,203,169,161,160,151,32,237,203
160 DATA32,155,250,76,181,196,16,7,86,101,114,105,102,121,105,110,103,32,46,46
170 DATA0,13,10,84,65,80,69,32,69,82,82,79,82,32,46,46,46,13,10,86,101,114,105
180 DATA102,105,99,97,116,105,111,110,32,97,98,111,114,116,101,100,46,13,10,0
190 DATA169,216,160,151,32,237,203,32,133,250,76,107,201,13,10,84,65,80,69,32
200 DATA38,32,77,69,77,79,82,89,32,77,65,84,67,72,46,13,10,86,101,114,105,102
210 DATA105,101,100,32,79,75,46,13,10,0
```

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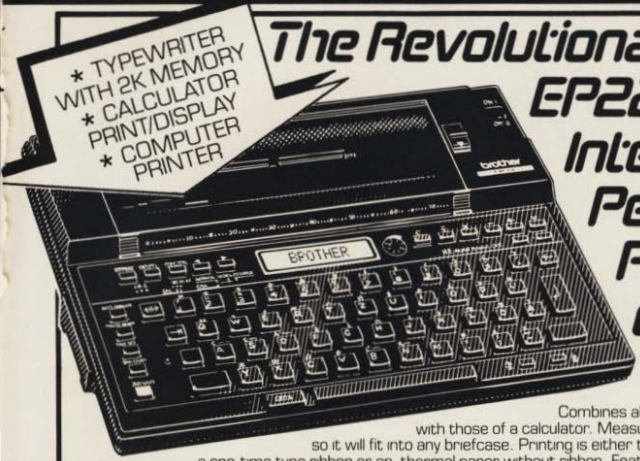

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Damian McComb details a method of extending Vic-20 commands vocabulary. A 3K expansion is necessary to execute this program.

VIC EXPANSION

IN THIS SERIES FOR the Vic-20 I aim to explain how it is possible to add commands to the Vic's Basic, and to extend the Basic by 42 commands. The program to do this will require a 3K expansion but if you have an expansion board you can also use additional 8K or 16K RAMpacks.

The set of commands I have written give several advantages to the user; First, there are some commands which are programming aids, including Trace and Renumber. There are others which will make converting programs intended for other micros a lot easier such as Curset — an equivalent to Print-at — Paper, Zap and Ping.

There are some commands which will greatly speed up operations which would have needed to be done in several steps before, such as Fill. But perhaps most important are the commands which exploit the very good colour, sound and graphics features of the Vic and make it very easy to use them. These include Sound, Mode, Window, Ink and

(continued on next page)

```
FOR "£" READ INVERSE POUND SIGN
 0 POKE56,22:POKE55,7:CLR
 1 POKE36879,238:PRINT"■■■
```

(continued from previous page)
Scroll. There is a complete list of the commands in table 1.

For the Vic to be able to recognise commands it must have a list of them stored somewhere in memory and, in fact, it lies from $C09E to $C19E. This list is called the Token Table and is used for two purposes — to recognise commands entered and to reprint them when a listing is required.

As well as the list of keywords there is also a table of dispatch locations — held from $C00C to $C09D. This table holds the address for each command that the interpreter jumps to — each command has a code for example Poke is 151. When the interpreter incounters the Poke command it simply reads the 151st address from the list of dispatch locations and jumps to it. That address is the start of the machine code routine to perform Poke.

The solution to adding new commands is now fairly obvious. We simply add more statements on to the end of the Token Table and add the appropriate addresses to the list of dispatch locations. However, there are two problems with this. First, there is no room above these lists as it is taken up by other data, and secondly they are held in fixed ROM.

However, there is one feature of the Vic which makes it very easy to bypass this problem and makes the Vic extremely versatile in this and other respects. That feature is the existance of indirect vectors from 768 to 819 which are held in RAM. These vectors are used by the interpreter as indirect jump addresses to carry out certain operations. Table 2 shows the vectors used for executing Basic statements.

By harnessing the last four of these vectors it is possible to extend the Basic. The crunch tokens routine converts commands entered by the user into their appropriate codes. These codes speed up the Basic and save a lot of memory. The list routine reconverts the codes back into their printed forms and prints them. The third vector reads the code of a statement, reads the corresponding start address or dispatch locations and jumps to it. The final vector is used for calculating numbers which accompany commands — the parameters.

Table 1. List of new commands.

Resume	Paper	Switch
Fill	Bdr	Zap
Cls	Aux	Ping
Err	Repeat	Mode
Window	Pause	Renumber
Sound	Curset	Trace
Music	Reset	Doke
Ink	Kill	Put
Lomem	Beep	Brk
Himen	Fetch	Set screen
Set case	CLD	Scroll
Break	Ssv	Mot
Irq	Boom	Joy
Pen	Pad	Key

Table 2.
768-769 = Routine to print error messages
770-771 = Basic warm start
772-773 = Crunch tokens routine
774-775 = List routine
776-777 = Routine to execute a command
778-779 = Get an arithmetic element

There are two kinds of commands in Basic — statements and functions. These are dealt with by the last two vectors respectively.

You may now be wondering how can these vectors help you to add to the token table and dispatch lcoations. To accomplish this, new routines have to be written to carry out the functions of the four above mentioned vectors. These routines are known as wedgees since they are simply insertions into the interpreter. Whereas the original routines read the data from ROM, your new routines will read the new commands from RAM and then jump to read the original ones.

Listing 1 is the first part of this three part program and its purpose is to insert wedges into the four vectors needed and to store the new Token Table and dispatch locations in RAM.

If you cannot wait for the further installments of this program or would rather not have to type them in, a cassette is available containing the extended Basic and a few demonstration programs along with a game for the new Basic. The cassette costs £4.50 from: Extended Basic Offcer, 23 Woodlawn Drive, Dungannon, Co. Tyrone, BT70 1AJ.

(listing continued from previous page)

```
97 DATA42,52,CB,53,45,54,53,43,52,45,45,CE,53,43,52,4F,4C,CC,4D,4F,D4
98 DATA4A,4F,D9,50,45,CE,50,41,C4,4B,45,D9,53,57,49,54,43,C8
110 DATA00,END
117 REM **              117 REM ** VECTORS     117 REM **
118 DATA20,7C,C5,A0,05,B9,FB,01,F0,57,C9,22,F0,47
119 DATAC9,41,90,40,C9,5B,B0,3C
120 DATA84,B1,A2,00,86,0B
130 DATA38,FD,B1,04,F0,13,C9,80,F0,16
140 DATABD,B1,04,F0,27,30,03,E8,D0,F6
150 DATAE6,0B,A4,B1,A9,C8,B9,FB,01,E8,D0,E0
160 DATAA6,B1,A5,0B,18,69,CC,9D,FB,01
170 DATAC8,E8,B9,FB,01,9D,FB,01,D0,F6,A4,B1
180 DATAC8,D0,B0
190 DATAC8,B9,FB,01,F0,06,C9,22,D0,F6,F0,F1,60
200 DATA08,C9,FF,F0,2A,24,0F,30,26,C9,CC,90,22,28
210 DATA38,E9,CB,AA,84,49,A0,FF
220 DATACA,F0,08,C8,B9,B1,04,10,FA,30,F5
230 DATAC8,B9,B1,04,30,05,20,D2,FF,D0,F5
240 DATA4C,EF,C6,28,4C,1A,C7
250 DATA20,73,00,C9,CC,90,19,C9,F1,B0,15,20,1F,06,4C,AE,C7
260 DATAE9,CB,0A,A8,B9,5E,04,48,B9,5D,04,48,4C,73,00
270 DATA20,79,00,4C,E7,C7
280 DATAA9,00,85,0D,20,73,00,C9,F1,90,13,C9,FE,B0,0F,E9,CB
290 DATA0A,A8,B9,5E,04,48,B9,5D,04,48,4C,73,00
300 DATAA5,7A,D0,02,C6,7B,C6,7A,4C,86,CE,20,8A,CD,4C,F7,D7
997 REM
998 REM ** POKE IN
999 REM
1000 FORI=0TO76:READA$:GOSUB10000:POKE5640+I,N:NEXT
1100 I=5717
1110 READA$:IFA$="END"THEN1200
1120 GOSUB10000:POKEI,N:I=I+1:GOTO1110
1200 I=5801
1210 READA$:IFA$="END"THEN1300
1220 GOSUB10000:POKEI,N:I=I+1:GOTO1210
1300 FORI=6001TO6234:READA$:GOSUB10000:POKEI,N:NEXT:GOTO20000
10000 A=ASC(A$)-48:B=ASC(RIGHT$(A$,1))-48:N=B+7*(B>9)+16*(A+7*(A>9)):RETURN
20000 PRINT"■NOW LOAD THE 2ND PART■"
```

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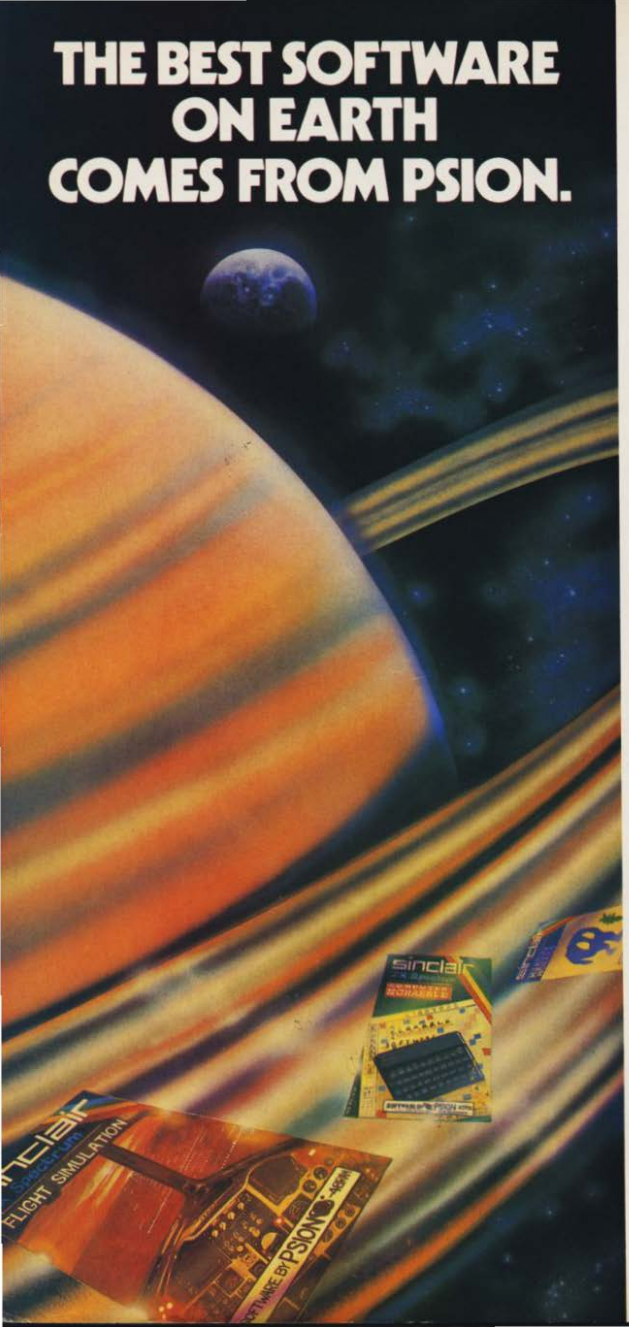

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6809 DRAGON EXPRESS

John Nash explains more machine-code for Dragons.

NOW THE TIME has come to look in more detail at how machine code is put together. First, you will need to understand the concepts of addresses and numbers. For example, my house is number 30, and five people live there, so you could say the contents of address 30 is five. Basic does not use addresses, except for special Pokes, but calls variables by names, thus: V1, V2. You cannot do this in machine code but you can use any address or pair of addresses as a variable.

Another concept you will require, especially if working without an assembler, is hexadecimal numbers. This works in a similar way to decimal, except that the first column contains numbers up to 15 (0F), the second, numbers up to 240 (F0), the third, numbers up to 3840 (F00), and the fourth, numbers up to 61440 (F000). If we add all the columns up, we get 65535 (FFFF), which is the largest number our chip can handle directly.

It splits the number into two parts, and stores the high byte — first two hexadecimal digits — in the first address, and the low byte — second two hexadecimal digits — in the second address of a pair. Note that this is different from chips such as the Z-80, if you have used these. Our instruction set also has two types of instructions, those using one byte of memory — 8-bit — and those using two bytes — 16-bit — more of this later.

The best way to learn machine-code programming is to look at programs, and to do this, you will need to disassemble them. If you have an assembler-monitor, there is no problem, but if you do not, you will need to get a book such as *The MC-6809 Codebook* by C D Warren, TAB Books, distributed by W. Foulsham and Co. You will then need to look up the codes, some of which are one byte, some of which are two, and work out from the instruction's meaning how many address or number bytes you would expect to follow it. Yes, it is easier with a monitor program, which does all this automatically. There is a steadily increasing amount of published 6809 code as listings, and of course you could always look in the ROM. Try

```
Print N, Hex$(Peek(N))
```

for the range 32768 to 49151, using a loop to do this in Basic. This will show you your ROM's operating system, which is, of course, a large machine-code program.

All computers actually do is to move numbers from one place to another, so methods of storing numbers are one of the more important facets of programming. In machine code, you have three options: chip registers, RAM addresses and the stack. These have somewhat differing uses and limitations, so I shall describe them separately.

■ Chip registers — These consist of the following: two eight-bit registers, A and B, which can be used as a single 16-bit register, D. These registers are the most versatile and have the most instructions available, so they get used most. Then there is a pair of index registers, each of 16-bits, called X and Y. These are of particular use in indexed addressing, but can also store numbers and perform some arithmetic operations.

Next, there is a user stack register, U, which is also 16-bit. This is primarily for holding the user stack pointer but can also store a number, and perform indexing and calculating operations. There is a similar register, eight, which is the hardware stack pointer. Finally, there are three special eight-bit registers: CC, which holds condition codes or flags, DP, for direct addressing, and PC, the program counter register, which shows where the program has reached. We shall not be using eight, CC, DP or PC at the relatively simple level of machine code under discussion.

When do you use the chip registers? The answer is for most operations — it is quite surprising how few routines need more than four or five registers. The chief thing to remember is that all the chip register values are lost when you return to Basic, so, if you need their values, you will have to store them in RAM addresses before returning.

■ RAM addresses — these are slower and more cumbersome than chip registers, but also more permanent, as they can take their values back to Basic. Use RAM storage when you run out of chip registers, and when you need to take values back with you, or pass them from Basic to a machine-code routine in the other direction. One register stores eight-bits, while a pair stores 16-bits, High byte first.

■ The stack — actually there are two stacks, but since the hardware one is used for return addresses, we shall avoid it at this stage. The user stack is entirely at your disposal and works as follows.

It starts from the address in the U register-1, and grows downwards in memory as you push numbers into it. An often-used and good analogy is a spring-loaded plate stack in a canteen, where you push plates in the top, and they push those already in there further down. When you pull them out, the last ones in come

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out first, and the others pop up to fill the space. The stack works exactly like this, and has two instructions, Push and Pull. corresponding to put in, and take out.

I cannot cover all modes of addressing in detail, but will concentrate on the ones that will be most useful to us in our short routines.

■Inherent addressing is the simplest form, and requires no operand number following the instruction because it is implied or unnecessary, thus, CLRA clears A, RTS returns from the subroutine.

■Immediate addressing has a number — data — for the operand. Most assemblers use a sign such as # to indicate this, so, LDD #$7FFE will load D with 7FFE (32766). The $ sign indicates hexadecimal on the assembler I use.

■Extended addressing will be assumed unless you specify otherwise. In this mode, the operand is a memory address, and the contents of that address will be obtained, thus, LDD $8000 would put the contents of the first address of your ROM into register D. This mode of addressing is specified by > in some assemblers. Direct Page addressing is a special variant where the high byte is stored in the DP register, resulting in greater speed of access, but this need not concern us.

■In register addressing, there is no operand, because you are manipulating data between chip registers only. There will generally be a postbyte which specifies which registers to use, but this is calculated automatically by the assembler. For example, TFR D,X transfers the value in D to X.

■Indexed addressing is used primarily with the X and Y registers, but we could also use it with U. In this mode, the operand itself is the X or Y register, which contains an address number. Various operations are possible, as shown in the examples. The assembler indicates this mode with a comma. Examples of this are as follows:

■LDX #$400 then STA ,X will first load X with the beginning of the text screen — $400 — then store A's contents in $400. If A had contained a character code, the character would then appear on the screen.

■If you had put STA ,X+ in the previous example the X register value would be incremented by +1 after the operation. This has obvious uses in graphics: LDX #$400 LDA #159 (decimal) STA ,X+ has the makings of a program to clear the screen to yellow. All you need extra is a CMPX #$600 to see if you have reached the end of the screen, and a branch instruction such as BNE Start to repeat if you have not. Other forms allowed are,

X+ +

which increments twice, to get the next 16-bit register rather than eight-bit, and,

-X

and

--X

which decrement first, before storing, as implied by their order of printing.

■You can alternatively specify an offset fox X either as a number or as the contents of A or B. LDX #$7E00 then LDB 5,X will load B with the contents of $7E05-32261. LDA #$7E00 LDB A,X would achieve exactly the same thing. These instructions are useful when youw ant to effectively increment the address pointed to by the indexing register, X or Y, while still retaining its old value.

In relative addressing, the operand after the instruction is assumed to be relative, that is, go back or forward n addresses. The main use of this is by Branch instructions, which come in two forms: ordinary and long. These do the same thing except that you use the long form like LBRA if the range is greater than 127 to −128. This mode is expressed in two's complement arithmetic — see my first article for explanation. Example: BRA Start or LBRA Start mean go back, or on to the address which we have decided to call Start.

Indirect addressing is like saying: "I do not know where James is, but Sally does, so I will ask her." You store an address in another address, and then get back the contents of the second address, whose address is itself stored in the first address. Some examples may help:

1. LDA ($5500) would load A with the contents of the address in $5500, so that if $5500 and $5501 contained $30 and $00 respectively and $3000 contained $20, then A would finally contain decimal 32.

2. Indirect addressing will also work with the indexed mode, so that LDB (2000,Y) would load B with the value in the address indicated by Y+2000.

I have not included the whole instruction set, but only the instructions which I have found the most useful. For the rest, see a manual on 6809 programming.

Note that instructions using a single eight-bit register are eight-bit, refer to a single RAM address if they use it, and handle numbers in the range 0 to 255 — $0 to $FF. This is minus 128 to plus 127 — $80 to $7F — if relative. Instructions using 16-bit need a 16-bit chip register and/or two RAM addresses. They can handle numbers in the range 0 to 65535 — $0 to $FFFF — or minus 32768 to plus 32767 — $8000 to $7FFF — if relative. In the table below, AM refers to addressing modes allowed: EXT. is extended INDEX is indexed, INH is inherent and IMM is immediate. Note that indirect addressing is allowed with extended addressing, and with most forms of indexed addressing.

LD: Loads register with number or contents of address. Eight and 16-bit forms: AM, EXT, Index, IMM.

Forms: LDA LDB LDD LDX LDY LDU

ST: This is the opposite instruction to LD: it stores the register contents in memory. Bit size and addressing are the same as LD, except that obviously you can't use immediate addressing, because you cannot store a register

Table 1. Assembly listing of codes

The columns are as follows, left to right:

1. Hexadecimal address where instruction is located — this is not relevant.
2. Hex. code, consisting of one or two bytes. This is the actual instruction.
3. OPERAND, the number, address (or Postbyte if using indexed addressing). See Tables 2 & 3 for calculation of Postbyte.
4. Assembler line number, not relevant.
5. Mnemonic code.
6. Operand for mnemonic code.
7. Comment.

1218	12		00030	NOP		SPARE
1219	50	1122	00031	LDD	#$1122	IMMEDIATE
1220	8E	1122	00040	LDX	#$11	
1223	108E	1122	00050	LDY	#$11	
1227	CE	11.	00060	LDU	#$11.	
122C	12		00070	NOP		SPARE
122D	B6	3456	00080	LDA	$3456	EXTENDED
1230	F6	3456	00090	LDB	$3456	
1233	FC	3456	00100	LDD	$3456	
1236	BE	3456	00110	LDX	$3456	
1239	10BE	3456	00120	LDY	$3456	
123D	FE	3456	00130	LDU	$3456	
1240	B7	3456	00140	STA	$3456	
1243	F7	3456	00150	STB	$3456	
1246	FD	3456	00160	STD	$3456	
1249	BF	3456	00170	STX	$3456	
124C	10BF	3456	00180	STY	$3456	
1250	FF	3456	00190	STU	$3456	
1253	A6	84	00200	LDA	,X	INDEXED- NO OFFSET POSTBYTE
1255	E6	84	00210	LDB	,X	
1257	EC	84	00220	LDD	,X	
1259	AE	84	00230	LDX	,X	
125B	10AE	84	00240	LDY	,X	
125E	EE	84	00250	LDU	,X	
1260	A7	84	00260	STA	,X	
1262	E7	84	00270	STB	,X	
1264	ED	84	00280	STD	,X	
1266	AF	84	00290	STX	,X	
1268	10AF	84	00300	STY	,X	
126B	EF	84	00310	STU	,X	
126D	12		00320	NOP		SPARE
126E	8B	11	00330	ADDA	#$11	IMMEDIATE
1270	CB	11	00340	ADDB	#$11	
1272	C3	3456	00350	ADDD	#$3456	
1275	8B	22	00360	ADDA	#$22	
1277	CB	22	00370	ADDB	#$22	
1279	B3	3456	00380	SUBD	#$3456	
127C	12		00390	NOP		SPARE
127D	BB	6789	00400	ADDA	$6789	EXTENDED
1280	FB	6789	00410	ADDB	$6789	
1283	F3	6789	00420	ADDD	$6789	
1286	12		00430	NOP		SPARE
1287	AB	84	00440	ADDA	,X	INDEXED- NO OFFSET POSTBYTE
1289	EB	84	00450	ADDB	,X	
128B	E3	84	00460	ADDD	,X	
128D	80	11	00470	SUBA	#$11	IMMEDIATE
128F	C0	11	00480	SUBB	#$11	
1291	B3	3456	00490	SUBD	#$3456	
1294	12		00500	NOP		SPARE
1295	B0	3456	00510	SUBA	$3456	EXTENDED
1298	F0	3456	00520	SUBB	$3456	
129B	B3	3456	00530	SUBD	$3456	
129E	12		00540	NOP		SPARE
129F	A0	84	00550	SUBA	,X	INDEXED- NO OFFSET POSTBYTE
12A1	E0	84	00560	SUBB	,X	
12A3	A3	84	00570	SUBD	,X	
12A5	12		00580	NOP		SPARE
12A6	3D		00590	MUL		
12A7	12		00600	NOP		SPARE
12A8	84	45	00610	ANDA	#$45	IMMEDIATE
12AA	C4	45	00620	ANDB	#$45	
12AC	8A	45	00630	ORA	#$45	
12AE	CA	45	00640	ORB	#$45	
12B0	88	45	00650	EORA	#$45	
12B2	C8	45	00660	EORB	#$45	
12B4	12		00670	NOP		SPARE
12B5	B4	2345	00680	ANDA	$2345	EXTENDED
12B8	F4	2345	00690	ANDB	$2345	
12BB	BA	2345	00700	ORA	$2345	
12BE	FA	2345	00710	ORB	$2345	
12C1	B8	2345	00720	EORA	$2345	
12C4	F8	2345	00730	EORB	$2345	
12C7	12		00740	NOP		SPARE
12C8	A4	84	00750	ANDA	,X	INDEXED- NO OFFSET POSTBYTE
12CA	E4	84	00760	ANDB	,X	
12CC	AA	84	00770	ORA	,X	
12CE	EA	84	00780	ORB	,X	
12D0	A8	84	00790	EORA	,X	
12D2	E8	84	00800	EORB	,X	
12D4	12		00810	NOP		SPARE
12D5	4A		00820	DECA		IMPLIDITE
12D6	5A		00830	DECB		
12D7	4D		00840	TSTA		
12D8	5D		00850	TSTB		

content in a number. It can appear as follows:

Forms: STA STB STD STX STY STU

next, the arithmetic functions. These are for use with the accumulator registers, A, B and D.

ADD: This has eight-bit — ADDA, ADDB — and 16-bit — ADDD — versions, and adds a value from one or two memory registers into A, B or D. AM: IMM, EXT, Index.

SUB: This is the complementary pair of Add and all the same remarks apply. It subtracts the contents of one or two memory addresses from the A, b or D register.

Forms: SUBA SUBB SUB

MUL: this is an unusual but useful instruction: it multiplies the contents of A and B together and leaves the result in D. AM: INH.

Form: MUL

Next, we come to the bit manipulation instructions, which function on individual bits in the registers. You might use these to test for certain bits set, for input/output operations — I/O — for example. You need these instructions for converting high-resolution graphics into printer instruction. All this group of instructions have the same address modes: IMM, EXT, INDEX. All are eight-bit only.

AND performs a logical and between the contents of A or B and a memory register, and leaves the result in A or B. This is different from a Basic AND, and checks each bit in turn.

If both the memory and the accumulator — A or B — has a 1 in bit N, then a 1 is left, otherwise a 0. For example 10001111 and 00110110 gives 00000110.

Forms: ANDA ANDB.

OR is in some ways the counterpart of AND, because it gives a 1 in the accumulator if either or both of the bits being compared was a 1. To repeat the example: 10001111 or 00110110 gives 10111111. Note the difference from the Basic OR.

Forms: ORA ORB.

EOR completes this trio: it stands for exclusive or, meaning that the bits are compared as before, but if both are 0 or both are 1, a 0 will result. You will only get a 1 if one bit is zero and the other 1. In our example, 10001111 EOR 00110110=10111001.

Forms: EORA EORB

The rotate and shift instructions are conveniently taken together because their operations are similar. Again, these are eight-bit, but the addressing modes are not quite the same as above: rotate and shift use INH, EXT, and INDEX.

LSL moves all the bits left by one, effectively multiplying by two. Bit 0 becomes 0, and bit 7 passes into the carry bit, where you could detect it with an ORCC — OR condition code register — for example. Thus, if we put 10011011 in A and then do LSLA, we get 00110110.

Forms: LSLA LSLB

LSR is analogous except that the bits are all pushed one to the right. A 0 is put into bit 7 — left hand — and bit 0 spills off the end into the carry bit. LSR effectively divides by 2.

Forms: LSRA LSRB

ROL: This instruction is a little different from LSL. Again, the bits are all moved one to the left, abut the carry goes to bit 0, while bit 7 goes into the carry. This is a true "rotation" through nine bits — eight + carry. Again, this has the following address modes INH, EXT, INDEX.

Forms: ROLA ROLB

ROR: As you might expect this rotates to the right, again passing through the carry bit. Each of these ROR or ROL instructions moves the bits by one place.

Forms: RORA RORB

ROR, ROL, LSR and LSL can all also be used on memory registers, in exactly the same way. This is what the extended and indexed addressing refers to.

The Branch instructions all work in a similar way, so are conveniently listed together. All use relative addressing, that is, are followed by a number to indicate the size of the forwards or backwards branch. All also have a long branch form signified by a prefix L. For example, LBEQ, LBRA and so on.

All the branch instructions rely on testing flags, which are usually set up by an immediately preceding CMP instruction. Taking them in alphabetical order, and including the most useful ones only:

BEQ — Branch on equal, branches if the two values are equal.

BGE — Branch if greater than or equal.

BGT — Branch if greater.

BLE — Branch if less than or equal to zero — <=0.

BLS — Branch if lower or the same.

BLT — Branch if less than 0 — <0.

BNE — Branch if unequal.

BRE — Branch always.

LBEQ; LBGE; LBGT; LBLE; LBLS; LBLT; LBNE and LBRA are all fairly self explanatory, and again these are a selection from the set.

Example forms: BEQ START LBRA $4056

CMP: This instruction goes here logically. This means: compare memory with register, and has eight-bit and 16-bit forms. Its addressing modes are:

IMM, EXT, INDEX

As indicated above, its usual use is to set up the condition for a branch.

Forms: CMPA CMPB CMPD CMPX CMPY CMPU

There are some miscellaneous but useful instructions which I have grouped together.

DEC decrements an eight-bit register, A or B in the inherent mode, or a memory register in the extended or indexed mode. It subtracts one from the value in the register.

INC is the corresponding instruction, and increments by adding one to an accumulator or memory register.

Address for both: INH, EXT, INDEX.

Forms: INCA INCB INC M DECH DECB DECM

EXG exchanges two registers, which must be the same size, ie. both must be 8-bit or both 16-bit. The address mode is

INH.

Forms: EXG D,U EXG A,B.

TFR is similar, but transfers the value from Register 1 to Register 2, leaving Register 1 with its original value. This is a kind of copy instruction. The address mode is:

IMM

Forms: TFR D,U TRF A,B

(continued on next page)

```
1209 46          00060    KUBH
1204 56          00070    KUBH
1208 44          00080    LSRH
1200 54          00090    LSRB
1200 12          00100    NOP        SPARE
1204 79   1234   00110    ROL        $1234    EXTENDED
1203 70   1234   00120    ROL        $1234
1204 76   1234   00130    ROR        $1234
1207 74   1234   00140    LSR        $1234
1204 12          00150    NOP        SPARE
1203 69   04     00160    ROL        X        INDEXED  MODES PREFIX
1203 60   04     00170    ROR        X
1207 66   04     00180    LSR        X
1203 64   04     00190    LSR        X
1203 12          01000    NOP        SPARE
1204 27   FE     01010    BEQ        START
1206 2C   FC     01020    BGE        START
1208 2E   FA     01030    BGT        START
1204 2F   F8     01040    BLE        START
1206 23   F6     01050    BLS        START
1208 2D   F4     01060    BLT        START
1300 26   F2     01070    BNE        START
1302 20   F0     01080    BRA        START
1304 1027 6E47   01090    LBEQ       $7777
1308 102C 6E43   01100    LBGE       $7777
130C 1026 6E4F   01110    LBNE       $7777
1310 1029 6CEE   01120    LBLE       $7777
1314 1023 6CE7   01130    LBLS       $7777
1318 1020 6CE3   01140    LBLT       $7777
131C 1026 6CDF   01150    LBNE       $7777
1320 16   6LDC   01160    LBRA       $7777
1323 12          01170    NOP
1324 12          01180    NOP        SPARE
1325 81   23     01190    CMPA       #$23     IMMEDIATE
1327 C1   23     01200    CMPB       #$23
1329 1083 2345   01210    CMPD       #$2345
1320 8C   2345   01220    CMPX       #$2345
1330 108C 2345   01230    CMPY       #$2345
1334 1183 2345   01240    CMPU       #$2345
1338 12          01250    NOP        SPARE
1339 B1   4567   01260    CMPA       $4567    EXTENDED
133C F1   4567   01270    CMPB       $4567
133F 1083 4567   01280    CMPD       $4567
1343 BC   4567   01290    CMPX       $4567
1346 108C 4567   01300    CMPY       $4567
1349 1183 4567   01310    CMPU       $4567
134E 12          01320    NOP        SPARE
134F A1   04     01330    CMPA       X        INDEXED  MODES PREFIX
1351 E1   04     01340    CMPB       X
1353 1083 04     01350    CMPD       X
1356 AC   04     01360    CMPX       X
1358 108C 04     01370    CMPY       X
135B 1183 04     01380    CMPU       X
135E 12          01390    NOP        SPARE
135F 12          01400    NOP
1360 4C          01410    INCA       INCREMENT
1361 5C          01420    INCB
1362 4A          01430    DECA
1363 5A          01440    DECB
1364 12          01450    NOP        SPARE
1365 7C   1456   01460    INC        $1456    EXTENDED
1368 7A   1456   01470    DEC        $1456
136B 12          01480    NOP        SPARE
136C 6C   04     01490    INC        X        INDEXED  MODES PREFIX
136E 6A   04     01500    DEC        X
1370 12          01510    NOP        SPARE
1371 1E   03     01520    EXG        D,U      REGISTER  OPERAND  PREFIX
1373 1F   12     01530    TFR        X,Y      REGISTER  OPERAND  PREFIX
1375 8D   4567   01540    BSR        $4567    EXTENDED
1378 8D   FF     01550    BSR        START    RELATIVE
137C 17   6C00   01560    LBSR       $6FFF
137F 39          01570    RTS
1380 3F          01580    SWI
1381 40          01600    NEGA       INHERENT
1382 50          01610    NEGB
1383 70   1234   01620    NEG        $1234    EXTENDED
1386 60   04     01630    NEG        X        INDEXED  MODES PREFIX
1388 30   05     01640    LEAX       5,X      INDEXED  OFFSET  PREFIX
138A 31   2A     01650    LEAY       10
138C 33   CB 17  01660    LEAU       -2133
138F 36   10     01670    PSHU       X,Y      REGISTER  OPERAND  PREFIX
1391 36   06     01680    PSHU       X,Y
1393 37   20     01690    PULU       X
1395 37   36     01700    PULU       X,Y
00000 TOTAL ERRORS
01710    END
@START   1209
START    1204
```

(continued from previous page)

Note that again the registers must be the same size.

JSR or jump to subroutine transfers control to a subroutine. The address mode is:

EXT, INDEX.

BSR or branch to subroutine is similar except that it uses relative addressing.

RTS or return from subroutine is the instruction that takes you back at the end of a subroutine, either to the next address after the subroutine call, or, if there was not one, back to Basic. What this instruction actually does is pull the first return address from the hardware stack and jump to it.

SWI or software interrupt is the corresponding instruction to return control to the cartridge monitor system, when running a program from the cartridge to debug and test it, for example. An RTS in this situation will really mess things up, because there will not be a return address to go to.

NOP or no operation is a useful instruction, principally when you want to leave an address blank, or temporarily remove an instruction when debugging. Surprise, surprise — it does nothing.

NEG or negate — this command is eight-bit only, and replaces the contents of an accumulator or memory register with the two's complement — see article # 1 — of the previous contents.

AM INH., EXT.
Forms: NEGA NEGB NEG M

LEA or load effective address is used to add a value to a register which would not normally allow this, such as X, Y, U, D. For example LEAX 5,X adds 5 to the value in X, while LEAY 10,X loads Y with the value in X + 10. Note that these 'offset' values are decimal.

AM.INDEX (only).
Forms: LEAX N,X LEAU N,U etc.
Note: LEAD LEAA are not allowed.

Finally, we come to the Push and Pull instructions. These are stack operations.

PSHU pushes registers not including U onto the user stack, which grows downwards from U-1 as mentioned earlier. Its addressing mode is immediate, and its form is PSHU.

PULU is the converse, and pulls values of the user stack, placing them into the registers specified in the register list. PULU X pulls the top value and puts it in X.

We now have the essentials of addressing and instructions, and can write simple routines to do useful operations at high speed. If you are using an assembler, you will have few problems, and the mnemonics can be entered as shown. You will need counters to control your loops, and it is best to use up the X,Y and U registers, also possibly one of the accumulators, before you start using RAM addresses for storage.

It is quite surprising how few programs need more than three counters going simultaneously. You can assemble your program to a suitable address, near the top of memory, then debug it from the monitor. The best way to do this is to insert lots of breakpoints and stop to inspect the chip registers frequently, to see if they contain what they should. Do not be discouraged by errors — all programmers make them.

Once it runs, change the final SWI to an RTS and store the program on tape. Then try running it with the Basic calling routine. I shall be covering this in more detail next time, but for the moment, try an EXEC NNNNN instruction, where NNNNN is the first address of your program.

Finally, last month's mystery program. I give an outline of how this works:

Line 110 loads Y with the starting address of the storage area.
Line 120 loads X with 4639, which is the address of the right hand side of the screen, half way down.
Lines 130-180 are a loop which takes the value in the address in X and stores it in the table pointed to by Y. It then adds 32 to X to get the end of the next line, adds 1 to Y to get the next table position, and stores. It repeats until the bottom of the screen is reached (line 160 checks this).
Line 190 stores the end of the screen address in X
Lines 200-250 are a loop which gets the next screen address contents and stores it one address to the right – LEAY 1,X. This produces a scroll right, and line 230 checks for half the screen completed. Lines 260-270 set up the parameters for recovering the values from our storage table, and
Lines 280-330 are a loop that reads them back into the left-hand end of the screen.
Lines 310 checks for job finished.

This method of storing the last screen column and putting it back at the left hand side ensures the wrap around necessary for this kind of scroll.

Those of you who have an assembler can now relax, but those who do not will find the code tables below. It is not possible to list all possible combinations, as there are more than 1450 of them. However, I have given the codes mentioned in the article in the form of a hexadecimal assembly listing. To use them, you need to Poke the hexadecimal digits into your chosen addresses using a hex loader such as the one published in my first article.

You will see the term Postbyte in the table — this is a byte that comes after the instruction proper and relates to Register and Indexed addressing. The method for working this out is given in Table 3 for Register addressing and Table 2 for Indexed addressing. These Postbytes come after the instruction and before the operand, that is, second. You have to build them up from a series of bits, then convert the binary into a byte. This is a bother, but is all done automatically by an assembler. If you plan any serious machine-code work, an assembler will be essential, definitely not a luxury. It will also make debugging far easier. ■

Table 3. Postbytes for EXG, TFR and Push/Pull instructions

1. TFR AND EXG POSTBYTES are the same. They are arranged as two sets of four bits, 7 to 4 representing the source register, and 3 to 0 the destination.

D – 0000
X = 0001
A = 1000
B = 1001
Y = 0010
U = 0011
(S = 0100)

As an example, D to U would be: 00000011

For Push and Pull (PSHU & PULU) the Push order is Y, X, B, A, so they go into the stack in that order, and the Pull order is the reverse, so they come out in the order A, B, X, Y. The codes are shown below – note that there is no code for D; you just Push/Pull both A & B.

BIT 5 = Y
BIT 4 = X
BIT 2 = B
BIT 1 = A

(for completeness, bit 7 = PC, bit 6 = U (not allowed, bit 3 = DP and bit 0 = CC.)

The Postbyte specifies which registers to use, as shown in the table. Once again, you will have to synthesise the Postbyte from the bits.

Table 2. Postbytes for indexed addressing.

Four-bit offset addressing, where the offset is 2/-15 or less, is quite different from the rest.

BIT 7 IS 0
BITS 6 & 5 INDICATE THE REGISTERS – SEE BELOW
BIT 4 INDICATES THE SIGN – SET IF NEGATIVE
BITS 3 TO 0 CONTAIN THE ACTUAL OFFSET.

The remainder of the modes work as follows – only those discussed are included:

BIT 7 IS ALWAYS 1
BITS 6 & 5 SHOW THE REGISTER, AS FOLLOWS:

00 = X
01 = Y
10 = U
(11 = S, if required)

BIT 4 INDICATES INDIRECT ADDRESSING, which is not allowed for single autoincrement/decrement (,X + , -X) functions.

Bits 3 to 0 are as follows, using X to indicate an example register; could be X, Y, U or S.

,X + = 0000
,X + + = 0001
,-X = 0010
,- - X = 0011
,X = 0100
B,X = 0101
A,X = 0110
NN,X = 1000 (NN is a 7-bit number)
NNNN,X = 1001 (NNNN is a 15-bit number)

The 4, 7 and 15 bit offsets are in two's complement notation, so can take plus ve or minus ve values.

You will need to see what bits must be set from the table, then constitute a binary number. Then translate this into decimal as follows:

IF BIT 7 SET, ADD 128
IF BIT 6 SET, ADD 64
IF BIT 5 SET, ADD 32
IF BIT 4 SET, ADD 16
IF BIT 3 SET, ADD 8
IF BIT 2 SET, ADD 4
IF BIT 1 SET, ADD 2
IF BIT 0 SET, ADD 1

Now convert the resulting decimal number to hex, either from tables, or with the computer: Print(HEX$(N)). Doing it in your head is also possible, but may be prone to errors!

CHOOSING A HOME MICRO

WARNING

Choosing a home micro can be a daunting task to the newcomer, and with an ever increasing number of micros emerging on the market, even up-grading, say, from a ZX81 can be a risky and expensive exercise if the wrong decision is made. It is important to look at the real facts and specifications, and check exactly what you get for your money before choosing your micro-computer system.

THE PITFALLS

"DON'T LET THE ADD ONS ADD UP"

A number of large companies are offering packages that seem to be good value and low cost. These offers usually have a hidden sting inasmuch as the essential accessories such as connection leads, peripherals and software often carry very high cost premiums. e.g. software for low cost hardware usually costs between £29 and £49 for a ROM cartridge!!

CHECK THE QUALITY OF THE PRODUCT.

Raw materials are now an area where corners can be cut, and shoddy workmanship during 'building' can effect the 'up-time' of your unit. Areas to watch out for are unreliable edge connectors, corrosion and poor quality P.C.B.s. Low quality components and bad design will seriously effect the reliability of the end product, and can lead to false economy.

DON'T BUY A GAMES MACHINE

Unless you want just games and nothing else! With a games computer you are limited. Some computers, however, have the advantage of both games facility plus the whole world of computing to explore, as your interest and skills develop. A real computer system will allow you to expand your knowledge of the Hi-Technology world, and help earn its keep with its added uses in the field of education, communication and home business use.

SOFTWARE

Make sure the system you choose has a growing library of support software, to enable you to realize the full potential of your machine.

KEY POINTS TO LOOK FOR

● High Resolution Colour

In general most home computers have a poor graphics resolution (or detail). Check on the vertical and horizontal resolution in graphic mode and multiply the two numbers together. If the result is less than 35,000, then the graphics can hardly be considered high resolution. Without high resolution graphics displays such as those used in games tend to be "Chunky" in appearance.

● High Quality Sound

Some computers claim to provide a sound channel when in reality all that can be found inside the computer is a small buzzer controlled by electronic pulses. At the very least a sound facility should provide more than one channel and a raise channel as well (for gun shot effects in games for example). The best systems also provide envelope control of the sound channels to produce very sophisticated effects; very important for generating music. Also look for the ability to connect to external amplifiers.

● Keyboard

For accurate entry of programs and data into a computer it is important that the keyboard has a good tactile feel in operation. Coupled with acoustic feedback the user is fully aware when the computer has accepted his/her actions. Also of importance in a keyboard is layout. A standard computer keyboard layout will familiarise the user with the vast majority of computers used in the world of business and professional applications: very important if the purpose of purchasing a computer is educational.

● RAM

One of the most important features of a computer is the amount of RAM, or memory, included. In general the more powerful and exciting a computer program is the more RAM it requires. But take care, all computers are advertised quoting the total RAM used in the system. Computers use up a great deal of their own RAM for storing essential data and particularly in supporting the graphics display and the CPU. If it is less than 32K think again, is it enough?

● Computer Language

It is too dificult to program a computer in its own binary language so high level languages are used, the most popular being BASIC. However, there are a number of BASICs, some being very different from the rest. A de facto standard in the computer industry is Microsoft BASIC. Learn this one and you will be able to program in the majority of computer BASICs; such an important point if a home computer is to be used to educate your children to face the technology of the future.

● Expansion

As your interest and knowledge of computing grows, you will need a computer system that will grow with you: able to accommodate Printers, Disk-drives, Joysticks, Communications Modem, and Colour Monitor, as well as produce HI-FI sound effects.

● Software

The computer you choose should have a growing selection of utility software to make the most of its capability.
Remember, computing is here to stay. You can't learn to compute on a toy, or a device which does not behave like a real computer.
In short, look out for a computer which offers all the points above, and you will be sure of getting the best value for money

Choosing the right system carefully will save you from throwing your money away. Check full specification, plus peripherals and software prices, before you buy. Preferably choose a Real computer system that can expand to meet your needs.

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MODEM

Transam's Modem for the Epson HX20.

John Dawson found the thought of putting together and using a Modem quite daunting until he actually went ahead and did it. Now he finds it reliable and useful. Here he looks at operating procedures for the unit with particular reference to the Maplin Modem.

MAPLIN ON LINE

I HAVE BEEN USING the Maplin Modem and it has worked well, giving me access to a number of amateur and commercial databases around the country. The Modem has proved reliable and useful. It has worked satisfactorily on both A BBC Micro and an Apple II fitted with a Computech Diplomat serial card.

The Maplin Modem connects directly to British Telecom's telephone lines and this ensures the best signal possible in the UK and, consequently, low error rates. The alternative method for putting a signal on to the telephone line is to use a small loudspeaker near the mouthpiece and a microphone close to the earpiece to send and receive the tones that carry a message.

There is no electrical connection to the telephone lines in this type of Modem; instead, it is acoustically coupled — the computer produces a digital signal which is turned into two tones by the Modem and these are fed to the loudspeaker which whistles and chirps and sends the information down the line.

Unlike many acoustic couplers which are restricted to initiating calls, the Maplin Modem can both originate and answer calls. That means that the receive and transmit filters in the Modem can be switched between incoming and outgoing messages. This is important because two originate-only acoustically coupled modems will be unable to communicate with each other — one Modem must answer the other's incoming call.

The Maplin Modem relies on the operator to switch the Modem into the telephone circuit, it is not an auto-answer device. Using the Modem is quite straightforward; you dial the number you wish to communicate with and listen on your telephone until the call connects. A steady tone indicates that the computer at the far end is waiting for the outgoing tone from your Modem.

You switch the Maplin line switch on and replace your telephone handset on its rest. The remote computer will send a welcome message and then you can start to communicate. At the end of the exchange of information you switch the Maplin line switch off.

Whenever I have used the Modem with either a BBC micro or an Apple II computer the number of corrupted characters has been very low. In radio terms the best way to describe the results is solid copy. All the computers I have accessed — most of which are listed in figure 1 — use full duplex which means that a character typed onto the BBC micro does not appear directly on the VDU but is sent, instead, to the Modem and the remote computer.

(continued on page 171)

Figure 1. Computer databases

Distel	01 679 1888	Display Electronics
Maplin	0702 552941	Maplin Electronics
Rewtel	0277 232628	Radio & Electronic World
Forum 80 Hull	0482 859169	Electronic mail library
TBBS London	01 348 9400	
Mailbox 80	051 428 8924	Liverpool Electronic mail

Figure 2.

```
 10  HIMEM = &1FF0
 20  text = &2000
 30  textend = &2000
 40  start = &2000
 50  CLS
 60  PRINT TAB(10,10);"BBC
 terminal Utility"
 70  PRINT TAB(3,13);"PRESS 'T'
 for terminal program"
 80  PRINT TAB(3,15);"PRESS 'S'
 to send text to serial port"
 90  INPUT TAB(10,17) K$
100  IF K$ = "T" THEN 140
110  IF K$ = "S" THEN 790
120  GOTO 10
130
140 DIM INIT% 20
150 DIM CHAROUT% 20
160 DIM CHARREADY% 20
170 DIM CHARGET% 20
180 SERCON% = &FE10
190 ACIACON% = &FE08
200 ACIASTAT% = &FE08
210 ACIATRAN% = &FE09
220 ACIAREC% = &FE09
230 GOSUB 260
240 CALL INIT%
250 GOSUB 630
260 FOR S=0 TO 3 STEP 3
270   P% = INIT%
280   [OPT S
290   LDA #&13
300   STA ACIACON%
310   LDA #&56
320   STA ACIACON%
330   LDA #&6D
340   STA SERCON%
350   RTS
360   ]
370   P% = CHAROUT%
380   [ OPT S
390   .OUT1 LDA ACIASTAT%
400   AND #&0A
410   BEQ OUT1
420   STX ACIATRAN%
430   RTS
440   ]
450   P% = CHARREADY%
460   [ OPT S
470   LDA ACIACON%
480   AND #&01
490   STA &0404
500   RTS
510   ]
520   P% = CHARGET%
530   [ OPT S
540   LDA ACIAREC%
550   AND #&7F
560   STA &0404
570   RTS
580   ]
590   NEXT S
600 RETURN
610
620 REM VDU LOOP
630  CLS
640  *FX229,1
650 X% = INKEY(0)
660  IF X% = 27 THEN 760
670 IF X% = -1 THEN GOTO 690
680 CALL CHAROUT%
690 CALL CHARREADY%
700 IF A% = 0 THEN GOTO 650
710 CALL CHARGET%
720  ?text = A%
730  text = text + 1
740 PRINT CHR$(A%);
750 GOTO 650
760  textend = text
770  GOTO 50
780
790  REM SEND TO SERIAL PORT
800  text = &2000
810  *FX5,2
820  *FX8,3
830  VDU2
840  *FX6,0
850  REPEAT PRINT CHR$(?text);
860    text = text + 1
870    UNTIL text > textend
880  VDU1,26
890  VDU3
900  GOTO 50
```

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(continued from page 169)

The remote machine then echoes the character back down the line, through the Modem and into the BBC micro, where it is displayed on the VDU. Full duplex allows the simultaneous transmission and reception of data.

Half duplex, also available on the Maplin Modem, means that the terminal — the BBC micro plus Modem — transmits and receives data consecutively, and transmitted data is displayed locally before it is sent to the remote machine.

Many of the telephone numbers printed in one computer magazine or another turned out to be incorrect. Some of the computers are only connected to the Bulletin Board service between certain hours. You also, quite reasonably, have to be prepared for human voices on the other end of the line — "Sorry love, he's on holiday for two weeks". The numbers listed in figure 1 were correct at the time of writing.

The hardware is only part of the story because the Modem and computer on their own are just pieces of equipment with no function. In common with all peripherals you need some software to make the computer recognise and use the equipment you have connected. The BBC machine is particularly clever in this respect. The machine operating system, or MOS, allows you to work at a high level if you simply wish to control the flow of data out of the machine and the built-in assembler makes the development of a terminal package quite easy.

Figure 2 lists a Basic program which will set up the BBC micro either as a terminal or to transfer a file of information held in the machine to another computer. The terminal section of the program — lines 140 to 780 — is taken largely from Mike James' excellent book, *The BBC Micro — an expert guide.* The book is worth buying and the operation of the program is explained in some detail. The additional part of the terminal program stores each incoming character at the address pointed to by the variable "text".

When you have completed the exchange of data with the remote computer you can return to the main menu by pressing the Escape key. The program is very crude, uses far too many

MODEM

Goto instructions and could be turned into a number of neat, faster running procedures. It was developed in a hurry, it does work, but it needs refining — it is not an example of good programming.

Lines 790 to 900 send the data stored between "&2000" and "textend" to the serial printer port — the same RS-423 output as was used by the terminal program. The data is sent at 300 Baud — line 820 — and the file is concluded by sending a Control Z character — line 880. The purpose of this instruction is to terminate the transfer of information to a CP/M file using the Peripheral Interchange Program or PIP.

Someone said the other day that the Maplin Modem is over-engineered. That may be but it certainly works reliably and, despite the recent availability of single chip Modems, it represents good value for money. The isolating transformer is essential for any Modem that is to be connected to BT lines — careful construction is necessary to ensure that the completed equipment is electrically safe.

I expect to use the Modem and the BBC micro together to access an American database Colleague by going through the packet switched network for work purposes. The different frequency tones that are used in the US are not a problem because all you are doing is to make a local phone call to the packet switched entry point.

The RS-232 interface for the Sinclair ZX-81 computer is made by Cobra Technology Limited and it comes with software on a tape to turn the ZX-81 into a versatile terminal. The terminal software uses the Xon/Xoff protocol to control the flow of data into the computer and can dump the ZX-81 screen to the ZX printer.

One option at the start of the program will set up the system to look like a Telecom Gold terminal. Unfortunately I was unable to borrow a ZX-81 to test the Cobra interface with the Maplin Modem but in theory there should be no problems.

The Microdrives are now on sale for the Sinclair Spectrum. Probably the most interesting part of the new hardware is the interface between the Spectrum and the Microdrives. The interface has an RS-232 outlet and also sockets to set up a local area network or LAN for up to 64 Spectrum computers. The manual does not say how long the leads can be between computers on the net but if the same electronics are used for both the RS-232 and the LAN then you might expect to be able to run up to 50 metres of cable from one computer to the next.

You can direct the output from your computer to another specified computer on the network or you can broadcast a message or data for everybody to receive. The manual says that the output from your computer is marked for the recipient and if she or he is not waiting for the message your computer will wait for ever, attempting to get the message through.

Although you must sort out high level collisions it appears from the manual that more than one pair of stations may use the net at the same time. Low level collisions are apparently avoided. Sharing programs need never be a problem again although one report suggests that the network operates at 110 Kbaud.

Learning about computing happens in a series of steps. Moving information from one computer to another was quite a big step until I did it and then it was easy. The BBC machine is ideal for experimenting in this field. Connecting the Maplin Modem was remarkably simple and extending Mike James' original program was not difficult given the BBC user guide as a reference book. ■

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GETTING LOADED

■I am intending to market my own software, but I want to ensure that the cassette will load on any Sinclair Spectrum through any tape recorder. I have read that recordings made on some recorders will not load through other recorders. Could you please recommend a low-priced cassette recorder which I can use to produce recordings which will load on any Spectrum?

D G Britton,
Kingswood, Bristol.

UNFORTUNATELY, you are approaching the problem from the wrong end. Rather than try to find a cheap recorder which will work with all Spectrums you should invest in the most expensive cassette recorder you can afford. The standard of the *recording*, rather than the make of cassette player used to load the program back into the computer, is the most important thing to worry about. Alternatively, you could get your cassettes duplicated by one of the companies who specialise in reproducing computer software. This will only be a sensible path to follow if you will be selling large quantities of your programs.

TAPE CONTROL

■In your February issue you reviewed Spectrum hardware. Could you please tell me where I could obtain an Adams tape controller!

Brian Dowd,
Brookfield, Middlesbrough.

THE UNIT is available from Stephen Adams, 1 Leswin Road, London, N16 7NL.

STAR GAZER

■I am interested in amateur astronomy and particularly in the observational side. I have a Dragon 32 and would like to know if there is software available giving astronomical figures such as positions, distances, magnitudes of stars and planets for any given day. Could you help?

John Heffernan,
Amersham.

I HAVE NOT been able to locate a supplier of such software in the UK. However, *Creative Computing* magazine in America publishes a book of computer programs related to navigation using the stars, and this may well prove of interest.

You could contact, among other dealers, Elkan Electronics, Freepost, 11 Bury New Road, Prestwich, Manchester, M25 6LZ, for a copy of its extensive catalogue of Dragon products, to see if there is anything available which might be adapted to your needs. Buffer Micro Shop, 310 Streatham High Road, London, SW16 6HG, also provides a catalogue of Dragon products, although you must specify that it is for the Dragon and a stamp-addressed envelope is appreciated. Finally, if you would just like to play around with the stars, Stellar Services, 8 Fir Tree Vale, Leeds, LS17 7EY offers an astrology program called Zodiac F for £15.

TALK TALK

■I have seen advertisements for programs for the Spectrum and Dragon which enable the computer to speak without the need for extra hardware. How do they do this? Surely I should be able to do it on my BBC Micro without having to buy the special Acorn speech synthesiser.

Roger Jarman,
Marlow.

THE SPEECH is produced on the Spectrum and Dragon by machine code manipulation of the computer's sound output. It is perfectly possible to do it on the BBC Micro, but the results are, in general, grossly inferior to those produced by a custom-made speech unit.

I have heard some Spectrum "speech" that has had to be "translated" by the programmer before I could understand what it was supposed to be saying.

As well as being of much higher quality, speech produced by a custom-unit is much, much simpler to control than homebrew speech.

LEADING ZERO

■I have a problem relating to the Bulls and Cows program in the book *Illustrating Basic*. My computer, an Atari, accepts an input of 1230, but if I enter 0123, it ignores the leading zero. I have played with the relevant lines of the program, but to no avail. Your help in this matter would be most appreciated.

B Shore,
Portsmouth.

LEADING ZEROES are ignored by all computers and nearly all calculating devices. From my investigation of the Mastermind program you sent, I think the problem is simply that the program does not allow zero to be part of the four-digit code. There is no need to include a zero in the answer, at the start or anywhere in your numbers. This may be incorrect, but it appears so from the part of the program you sent.

In general, it is often easier to treat numbers as strings — using STR$ to change them to the string, and VAL and/or EVAL later on to get them back into number form — if they require extensive manipulation. Strings are much easier to cut up, and play with, than are numbers.

IN FUNCTION

■I have devised a 16K Spectrum game which allows two players to move individual characters about the screen. Each player has his own Inkey$ keys to press. Of course, if two keys are pressed at the same time, Inkey$ becomes an empty string, and there is no response. How can I get the computer to only look at one set of keys at a time.

C Bradley,
Roman Wood, Bracknell.

THE ANSWER is to use the In function, which allows more than one key to be read at a time. Use a line like IF IN 65278 = . . . THEN to get the effect you want. You can set up a simple routine to get the effect you want. You can set up a simple routine to get the computer to return the result of the In initially just by including a Print In . . . line in a program. In uses the following numbers : 63486, 64510, 65022, 65278, 61438, 57342, 49150 and 32766. The use of In is explained in the book *Delving Deeper into your ZX Spectrum* by Dilwyn Jones.

MEMORY LOSS

■Has my Vic-20 lost its memory? When I typed in some long programs which are meant to be for the unexpanded Vic-20, I often get an "out of memory" error. Sometimes a program which fits the first time I use it gives an "out of memory" error when loaded back in from the cassette. What is going on?

M Finch,
Preston.

AS YOU HAVE discovered, the Vic is very touchy when the memory is nearly full. When the Vic hits a Dim statement, as you know, it reserves space in memory for each element required. I suggest you use CLR to get rid of all values assigned to variables, and keep array sizes down to the absolute minimum.

DISABLING

■I have been writing programs on my 16K Spectrum. I know that you cannot break out of a machine code program. Is there any way of disabling the Break key when using Basic?

Rupert Hollom,
Abbey Dore, Hereford.

UNFORTUNATELY, THERE is no way this can be done in Basic. If, however, you want to know about this so you can protect your own programs, you can add lines to the listing — assigning the copyright, for example, to you — which cannot be removed from the listing by anyone.

If you want your name and copyright claim to be line number zero, which no-one can remove, make this the first two lines of your program:

```
1 LET A = PEEK 23637 + 256*PEEK
  23638: POKE A,0: POKE A + 1,0:
  STOP
2 REM (C) RUPERT HOLLOM
```

When you run this, then LIST, you will see line zero where line two used to be. All you have to do now is edit out line 1, and your name and copyright will be locked in the listing for ever.

SPRITELY SPRITE

■I own a Commodore 64. Could you please explain how I can move a sprite across the screen using keys or a joystick?

Andrew Clinch,
Bath.

SPRITES ARE NOT, as I am sure you have gathered, the easiest things in the world to use, but the reward of using them more than compensates for the effort required to understand them. A sprite is a character which you define. It will look just as you specify, in terms of shape and colour, and can be placed anywhere on the screen and moved under your control.

The *Commodore 64 Programmer's Reference Guide* explains how to position and move sprites on page 142. Combine this information with a routine to read the joystick position on page 344 of the same book or a standard Inkey$ subroutine to scan the keyboard, and you can move your sprites around. The guide is extremely valuable, but it demands much careful reading.

VIC POKE

■I own a Vic-20 and am very pleased with its performance. However, I would be please if you could tell me how to get the command Poke 650,128 — which puts a repeat function on all keys — to stay permanently in memory?

G Ashton,
St Helens,
Merseyside.

YOU ARE really asking if it is possible to change the contents of the Vic ROM. Although, as you know, RAM can and is changed everytime you enter something into the computer, ROM is fixed when you buy the machine. Therefore, there is no way, short of reprogramming the ROM to change the state of a particular address — 650, in this case. You will just have to continue to type the command into the machine at the start of each programming session, and possibly later in the same session if New resets the condition of that address. ■

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- Which Micro & Software Review, August

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- Popular Computing Weekly, 12 May & 23 June

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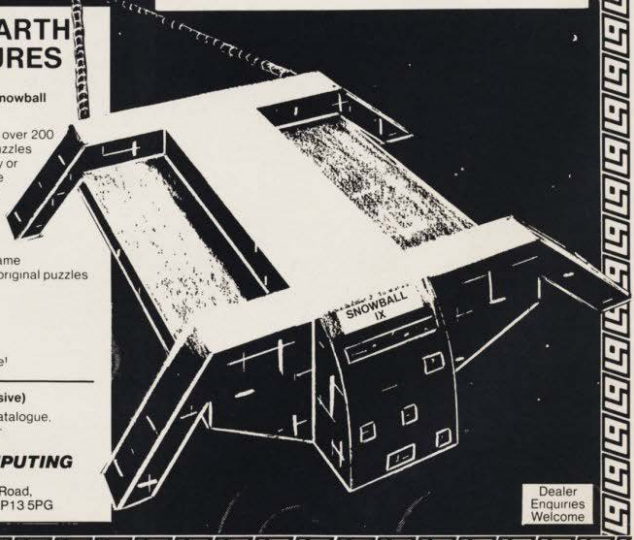

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King Kong

Stephen Hall and Nicholas Walmsley, Kendal, Cumbria.

SPECTRUM

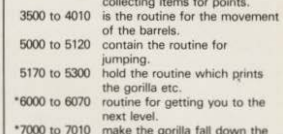
THIS PROGRAM IS for the 48K Spectrum. The control keys are in the instructions in the program. There are four levels, and each more difficult than the last.

The two barrels will sometimes bounce back off the edge of the screen or will reappear higher up. There are various items for you to collect, and for each one you get 100 points. If you have to jump to reach one, do not keep the jump pressed or you will carry on above it, and may bump your head. To reach the next level you must go up to the highest point on the screen and jump right, but if you are at the very top of the screen then just go right normally. Do not jump or you may be killed.

After each level your score is doubled and 100 is added.

11 to 16	contain the data for the user-defined graphics.
17 to 21	contain data for the levels.
30 to 70	set up user-defined graphics.
101 to 320	set up the first level.
390 to 580	set up the subsequent levels.
1000 to 1580	contain the main loop.
2000 to 2530	contain the routine for when you fall down a hole.
2550 to 2801	contain the high-score table routine.
3000 to 3040	contain the routine for collecting items for points.
3500 to 4010	is the routine for the movement of the barrels.
5000 to 5120	contain the routine for jumping.
5170 to 5300	hold the routine which prints the gorilla etc.
*6000 to 6070	routine for getting you to the next level.
*7000 to 7010	make the gorilla fall down the screen when you get through all the levels.
8000 to 8090	are the instructions.
9000 to 9999	sets up the machine code for the sound.

```
   1 CLEAR 59999  GO SUB 9000
   2 RANDOMIZE
   3 GO SUB 8000
   5 DIM n$(10,10): DIM h(10): F
OR f=3 TO 10: LET n$(f)=" UNTAKEN
": LET h(f)=0: NEXT f: LET h(1)=
1000: LET n$(1)="NICK": LET h(2)
=1000: LET n$(2)="STEVE"
  10 BORDER 6: PAPER 6: INK 1: C
LS
  11 DATA a,BIN 00011100,BIN 0
0100010,BIN 01111111,BIN 0000100
0,a,a,BIN 01001000,BIN 00110000
  12 DATA b,BIN 00011000,BIN 0
0100100,BIN 01000010,a,BIN 01111
110,a,a,BIN 00111100
  13 DATA c,BIN 00001111,BIN 0
0010010,BIN 00100001,BIN 00100000
1,a,BIN 00100001,BIN 00010010,BI
N 00001111,a,a,BIN 11111100,a,a
,1,1,2,BIN 11111100
  14 DATA d,BIN 00011000,BIN 0
0111110,BIN 00011100,BIN 00000100
,a,BIN 00011000,a,BIN 00100000,BI
N 00010100,BIN 00100010,a,BIN 00
1000100,BIN 00111110,BIN 00101
100
  16 DATA e,129,255,129,129,25
5,129,129,255,1,1,2,4,BIN 0001
1100,BIN 00100010,BIN 01000001,B
IN 10010000,BIN 10100000,a,a,a,a
,a,BIN 10010000,BIN 01001000,BIN
00101100,BIN 00010110,BIN 00101
111,a,BIN 01001110,BIN 01001000
,a,a,a,BIN 01010000,BIN 01010000
,a,BIN 01100000,128,64,32,BIN
01021000,BIN 10000100,BIN 00010
111,a,a,a,a,a,a,a,a,a
,BIN 00011100,BIN 00101100,BIN 0
1010100,"h",BIN 00101100,BIN 101
10010,BIN 00010010,a,BIN 00001010
,a,BIN 00101000,BIN 00111000
  17 DATA 32,2,2,6,8,12,3,3,6,
2,10,7,8,13,4,8,6,10,6,
10,10,2,24,16,8,5,7,4,0,1,32,24,
1,2,2,2,3,12,12,12,10,11,14
,4,16,16,12,16,16,12,24,11,14
,0,16,7,8,18,7,16,18,8,16,18,6
,00,8,7,0,8,12,9,19,9,16,13,10
,18,18
  18 DATA 0,1,32,0,18,13,14,13,2
,18,18,3,22,18,9,16,17,13,14,1,
,29,14,2,1,13,1,9,13,4,0,12,3,16
,9,3,20,9,6,29,9,2,0,8,4,29,4,3
,19
  19 DATA 28,0,19,1,12,1,16,9,8
,14,8,29,12,20,16
  20 DATA 3,1,0,1,0,1,0,1,71,4,
,8,12,8,10,3,2,16,3,2,20,3,1,
14,4,28,1,4,10,12,9,2,18,8,2,15
,1,29,1,19,9,1,20,10,1,11,1,22
,8,2,15,2,15,14,1,18
  21 DATA 16,13,16,12,2,0,18,3,4,18
,0,0,20,4,6,20,28
  22 DATA 2,0,2,9,2,9,2,10,28,8
,30,3,11,26,1,2
  30 FOR c=1 TO 14
  40 READ a$
  50 FOR f=0 TO 7
  60 READ b
  70 POKE USR a$+c,b
  80 NEXT f
  90 NEXT c
  100 LET i=0: LET l=0
  101 BRIGHT 1: BORDER 6: INK 1
PAPER 6: CLS
  102 OVER 0: INK 2
  105 FOR x=1 TO 140 STEP 32
  110 PLOT 0,x+2
  120 FOR n=1 TO 31
  140 DRAW 8,0: DRAW 0,4: DRAW -8
,0: DRAW 0,-4: DRAW 8,0
  150 NEXT n
  170 NEXT x
  175 GO SUB 5170
  250 FOR y=5 TO 19 STEP 4-2*(l>2
)
  255 PRINT AT y+1,RND*29: BRIGHT
1: INK 2: A
  260 LET l=28+RND
  261 LET s=26+RND: IF s<14 AND s
>0 THEN GO TO 261
  265 PRINT AT y,s
  290 IF l>2 THEN GO SUB 5270
  300 NEXT y
  310 PLOT 200,143
  320 DRAW -10
  350 TO 0,0
  390 RANDOMIZE: INK 2
  391 IF l=3 THEN LET for=32
  392 IF l=4 THEN LET for=25
  394 IF l=2 THEN LET for=23
  395 FOR t=1 TO for
  400 READ c
  410 PLOT b+8,b+8+6
  420 FOR x=1 TO c-1
  425 READ d
  430 DRAW 8,0: DRAW 0,-4: DRAW -
8,0: DRAW 0,4: DRAW 8,0
  440 NEXT x
  445 DRAW 0,-4: DRAW 6,0: DRAW 0
,4: DRAW -6,0
  450 NEXT t
  470 IF l=2 THEN LET for=8
  480 IF l=3 THEN LET for=8
  490 IF l=4 THEN LET for=8
  500 FOR c=1 TO for
  510 READ b: GO SUB 5270
  520 NEXT c
  530 GO SUB 5170
  540 BRIGHT 1: INK 2
  550 PRINT AT 6,1;"A
  560 PRINT AT 12,3;"B
  570 PRINT AT 18,30;"E
  580 IF l=2 THEN PRINT AT 0,16
INK 1;"CCCCCCD
  1000 LET y=0
  1010 IF y=0 THEN 4000: GO SUB 4010
  1020 BRIGHT 0: OVER 1: INK 6: FL
ASH 0
  1030 LET y=18: LET x=0
  1040 PRINT AT 1,8: OVER 1: INK 7
: BRIGHT 1: S
  1100 PRINT BRIGHT 0,AT y,x: F
  1105 IF SCREEN$ (y+1,x)<> " " THEN
GO SUB 2000
  1110 PRINT INK 2,AT p,q: CC
  1120 PRINT INK 2;AT p1,q1;" CC
  1125 IF INKEY$=" " OR INKEY$=" " THE
N LET sound=USR 60025
  1125 IF ATTR (y,x)=64 OR ATTR (y
,x)=50 THEN GO TO 3000
  1126 PRINT AT y,x;F
  1130 LET x=x+(INKEY$=" " AND x>2
)-(INKEY$="Z" AND x<30)
  1135 LET y=y-(INKEY$="A"AND y>1)+(INKEY
$="S" AND y<19)
  1140 IF INKEY$="Z" OR INKEY$="X"
OR INKEY$=" " THEN GO SUB 5000
  1150 PRINT AT p,q; INK 1;"CC
  1160 PRINT AT p1,q1; INK 1;"CC
  1170 IF l>1 THEN GO SUB 3510
  1180 IF SCREEN$ (p+1,q)<> " " THEN
LET p=p+1
  1200 IF SCREEN$ (p1+1,q1)<> " " TH
EN LET p1=p1+1
  1500 GO TO 1100
  2000 REM proc
  2005 PRINT AT y,x;F
  2007 IF y=1 THEN GO TO 6000
  2010 FOR p=1 TO 2
  2020 LET y=y+1
  2030 PRINT AT y,x;F
  2040 IF SCREEN$ (y+1,x)<> " " THEN
RETURN
  2060 GO SUB 3510
  2120 PRINT AT y,x;F
  2125 NEXT p
  2130 IF SCREEN$ (y+1,x)<> " " THEN
GO TO 2530
  2140 LET y=y+1: GO TO 2130
  2500 PRINT AT 6,3; OVER 0;
```



```
  2530 FOR x=1 TO 3: LET sound=USR
 60003: PAUSE 4: NEXT
  2540 IF INKEY$="Y" THEN CLS: RE
STORE 1: GO TO 100
  2550 CLS: FOR x=1 TO 10: IF s<
h(x) THEN GO TO 2580
  2551 NEXT x
  2560 PRINT AT 0,10; NO HIGH SCOR
E"'"THIS TIME"'"PRESS ANY KEY TO
USE": GO TO 2700
  2580 FOR r=9 TO x STEP -1: LET n
(r+1)=n$(r): LET h(r+1)=h(r): N
EXT r: LET n$(x)=" ": LET h(x)=s
  2590 INPUT "NAME"; n$(x);
  2700 CLS: PRINT AT 1,10;"HIGH SCORES
"'"10 JM TAB 10;"KN
  2710 INK 3: PRINT "HIGH SCORES
": OVER 1: TAB 0
  2720 FOR f=1 TO 10: PRINT n$(f);
TAB 18;h(f): NEXT f
  2800 INK 7: IF INKEY$="Y" THEN G
O TO 100: RESTORE 1: GO TO 100
  2801 GO TO 2800
  3000 REM
  3005 IF ATTR (y,x)=114 THEN GO
TO 2500
  3010 LET sound=USR 60035
  3020 LET s=s+100
  3030 PRINT AT 1,8; OVER 0; INK 7
: BRIGHT 1: S
  3040 PRINT AT y,x; OVER 0; INK 1
;"
  3050 GO TO 1130
  3500 REM
  3510 LET q=q+1: LET q1=q1+1
  3520 IF q1>30 OR q>30 THEN LET q
=1-(q>30): LET q1=1-(q1>30): GO SUB 4010
  3540 IF q>30 OR q1>1 THEN LET q=
q-1: IF p>1 THEN GO SUB 4000
  3550 RETURN
  4000 LET d=1: LET q=1: LET p=2+I
NT (y/2): RETURN
  4010 LET d1=-1: LET q1=29: LET p
1=2+INT (y/2): RETURN
  5000 LET g=INKEY$="X" AND x>30:
-INKEY$=" " AND x<2
  5005 BRIGHT 0
  5010 PRINT AT y-1,x;F
  5020 IF ATTR (y-1,x)=50 THEN GO
TO 2500
  5030 PRINT AT y-2,x+9;F
  5040 PRINT AT y-3,x+9;F
  5055 LET sound=USR 60000
  5060 PRINT AT y-2,x+9;F
  5090 LET x=x+2*g: LET y=y-2
  5100 BRIGHT 0
  5100: IF ATTR (y,x)=64 THEN GO TO
3000
  5120 RETURN
  5170 REM
  5175 PAPER 6: INK 2: FLASH 0
  5180 PRINT AT 0,11;"IL
  5190 PRINT AT 1,11;"JM G MEMP
  5200 PRINT AT 2,11;"KN ", INK 0;
"
  5220 PRINT AT 3,11;"
  5230 FLASH 0: PAPER 6
  5240 RETURN
  5260 REM
  5270 FOR x=0 TO 3
  5280 PRINT AT x+y,1; INK 1; H
```

(continued on page 179)

BBC

(continued from page 79)

screens which were Saved before the crash.

The interface between the Forth operating system and the backing store is essential for an effective Forth system. Forth definitions are stored within the machine in a compacted form and the source code stored externally on screens.

Screens are swapped in and out of the machine as required – automatically by the disc system, tediously with the tapes. The Forth operating system can become confused about which screen is in memory and which has been Saved.

The Forth itself is a standard '79 Forth system with extensions to allow effective use of some of the BBC's facilities. These are primarily the word >VDU for the VDU drivers; and Plot which apart from the use of post-fix notation is identical to the Basic Plot command. The manual gives some guidance concerning implementation of other facilities, notably the equivalent of the Sound and Envelope commands in Basic.

No guidance is given on how to implement the system clock or the A to D converters. The machine code primitives for these are not difficult to write if you are familiar with the MOS., 6502 machine code and Forth itself. It would have been useful for the naive user to have had these included in the dictionary somewhere or, failing that, explicitly given in the manual.

I managed to implement these in machine code but did not use the assembler supplied on the tape. For producing short pieces of machine code there is a simple way to include the routines as numeric opcodes within definitions. It is within the philosophy of Forth to keep definitions short and simple. If I wanted to include longer pieces of machine code then the assembler looks a useful tool.

The screen editor is used to write and edit screens prior to their being compiled into a Forth dictionary. I did not find it difficult to master, being used to buffer based editors on other machines. I imagine that people whose only editing experience has been screen based, as on the BBC itself will find it difficult. In practice I found myself using both the Forth and screen editors in tandem; possibly the best of both methods. The only thing apparently missing from the editor is a search and replace command. The extensible nature of Forth makes this very easy to implement.

Also supplied by Acornsoft is a manual. This is one of the best and one of the worst books on Forth I have read. The most useful feature is a dictionary which concisely and explicitly explains the meaning of almost every word included in the dictionary.

After a very gentle start in the first few chapters it then lurches between the low and very high level content in an alarming and frightening manner. As an implementation manual it has some disturbing omissions and the sparse index does not help in finding information. It shows signs of a hasty rewrite and has emerged on a mixture of levels which will satisfy nobody. I would suggest a second edition with the introductory material expanded and separated from the advanced.

In conclusion I would recommend Acornsoft Forth to anybody who has a BBC Micro.

Fintan Culwin

(continued from page 79)

advantages of Basic in being well suited for use on microcomputers with their relatively limited memory. It was originally designed for controlling radio telescopes by Charles Moore at Kit Peak National Observatory in Arizona in the early 1970's.

Forth's advantages are that it is compact, taking up even less of a system's memory than the typical Basic, and that it executes very fast. To the programmer it is very different to working in Basic, because Forth is an extensible language. It comes with a standard set of commands, the Dictionary, which you then add to, to build up your program.

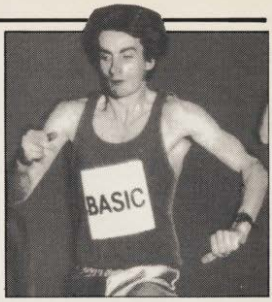
New commands, which are called Words in Forth, are created out of combinations of the old ones, or by writing machine code routines. Eventually you end up with a single word which when you type it in causes the whole program to Run.

Another distinctive feature of Forth is the stack, a sort of heap on which you throw numbers which you are about to use.

In Forth each programmer ends up creating virtually their own language. But the core Dictionary, what you get when you buy a Forth language system and all you have before you set to work, has to be agreed otherwise Forth would fragment into a thousand dialects very quickly.

Forth represents a new development as the dominant definition of Forth was arrived at not by a committee or corporation or academics but by the community of Forth users themselves meeting at Forth Interest Group meetings. FIG Forth is this standard Forth, arrived at in 1979.

There are still problems with Forth. Although it is fast and efficient, it is incredibly



difficult to read other people's Forth programs. Gary Kildall, inventor of CP/M, who is personally a C and Logo enthusiast, describes Forth as a write-only language for this reason.

Pascal, designed in 1971 by Niklaus Wirth, a Swiss University Professor is, on the other hand, very concerned with the human programmer's thinking. The language is named after Blaise Pascal who, as an 18 year-old, invented the first mechanical calculating machine in France in 1690. Pascal is intended to be easy for programmers to learn and retain.

To be frank, I do not like Pascal — it forces you to think in a particular way which might be good for you but which I would like to be optional. Niklaus Wirth had strong ideas about structuring programs — that is writing them in separate chunks, or modules, with each program module containing a complete logical thought. The modules are then

(continued on page 84)

ZX-81 FORTH

ZX-81 Forth from Sinclair loaded first time taking six minutes plus a further four minutes to load the editor which is written in Forth and Saved as a Forth file. With the editor loaded there is about 7K left for the application dictionaries.

The most surprising part of the system was the facility to Save the Forth definitions as Forth files. Using the editor a screen can be written, saved and loaded externally as a Forth file. There is no indication of the screen number as the screen is loaded or attempted to be loaded; which makes finding the file on the tape a little difficult.

Only one screen can be held in memory at one time. Once the screen has been written it can be Saved to tape with the word Flush and loaded for editing with List or for execution with Load. A fresh screen is prepared with n Clear where n is the screen number on the top of the stack.

The editor is vastly different from the Basic editor. It is used to write a screen initially and to edit it using a number of words for moving a pointer around the screen. When the pointer has been positioned there are words to delete and insert new text onto the screen.

Sinclair Forth is very close to standard implementation. All the control loops – Indexed, While and Until – are present as are all the expected stack, memory and dictionary manipulation words; it even supports recursion.

The character set has been renumbered to ASCII which would be incidental except that it allows programs to be written on the ZX-81 in high level Forth using the standard words, for implementation upon other machines.

The speed advantage of Forth on the ZX-81 is phenomenal. The slow mode of operation has disappeared; the screen is intact at all times. A sample 1 to 10,000 For/Next loop for example executes in about 4 seconds in Forth compared with over 80 seconds in Basic.

Also supplied with the tape are two printed booklets. The thickest of these is an installation guide. It includes details of tape operations as well as a brief introduction to ZX Forth and a glossary containing a definition of every word included in the Forth dictionary. An appendix also includes the machine code primitives for plotting on the screen. The other booklet is a useful and comprehensive guide to the editor.

Sinclair Forth for the ZX-81 supports the Forth philosophy by extending the machine to, or possibly beyond, its limits.

Sinclair Forth for the 48K Spectrum is almost identical to the ZX-81 version. Obviously some new primitives have been introduced to make use of the Spectrum's graphics and sound capabilities.

It also provides the Spectrum with a full screen editor as on the BBC.

Fintan Culwin

(continued from page 177)

```
5290 NEXT I
5300 RETURN
6000 REM
6020 LET score=score+100
6030 LET sound=USR 60059
6040 INK 1: CLS
6050 LET lives=lives-1: IF lives THEN LET
i=0: GO SUB 7000: RESTORE 17: GO
TO 101
6070 GO TO 390
7000 LET kong=0
7001 OVER 0: PRINT AT kong,11; I
NK 2; "IL"; AT kong+1,11; "UM"; AT k
ong+2,11; "KN": LET kong=kong+2:
LET sound=USR 60083: PRINT AT kon
g-1,11; "A"; AT kong-2,11; "A"
: kong=0: IF kong.18 TH
EN GO TO 7001
7010 RETURN
8000 PRINT AT 3,3;
```

```
8010 PRINT
8020 PRINT AT 14,5;"By    Stephe
n Hall,                   Nicho
as Walsley."
8030 PRINT "  The aim of the gam
e is to guide your man up to the
 top of the screen without getti
ng hit by the barrels KONG is th
rowing."
8035 PRINT #1; "Press any key to
continue"
8036 PAUSE 0
8037 CLS
8040 PRINT "He is there to stop
your man  rescuing his girlfr
iend who  KONG has kidnapped."
8050 PRINT "To rescue her you m
ust take yourman to the highest
point he can get to and jump rig
ht. The must do this four times
in a row. If your man is righ
t at the top of the screen just
move right DON T JUMP!"
8060 PRINT "  TAB 5; CONTROLS ; O
VER 1;TAB 5;
8070 PRINT "Left  Z  Right
  X  Down  S  Up  W"
"TO jump press CAPS-SHIFT and
direction  PRINT #1;"Press any
key to continue": PAUSE 0: CLS
: PRINT "BEWAREOF THE DOUN LEV"
"It will take you down whether
 is something to support you or
 not  I means death if your ma
n falls too far."
8080 PRINT "  You will only get
 points for thenats etc. if they
 are right  If a barrel rolls
over them ineypecome worthless."
8082 PRINT "  To start a new game
 press ""
8085 PRINT "  P.S  Mind he doesn
t bump his  head."
8090 PRINT #0; "Press any key to
start": PAUSE 0: RETURN
9000 RESTORE 9010: FOR f=60000 T
O 60108: READ a: POKE f,a: NEXT
f
9001 RESTORE 10
9010 DATA 1,5,10,33,255,0,17,10
0,229,213,197,205,181,3,193,209,
225,126,145,111,16,242,201,201
9020 DATA 33,100,1,17,1,0,205,18
1,3,201
9030 DATA 1,30,0,33,255,0,17,100
,0,229,213,197,205,181,3,193,209
,225,126,145,111,16,242,201
9040 DATA 1,10,100,33,255,0,17,7
0,0,229,213,197,205,181,3,193,20
9,225,126,145,111,16,242,201
9050 DATA 1,10,78,33,255,11,17,1
,0,229,213,197,205,181,3,193,209
,225,126,12,111,16,242,201
9999 RETURN
```

Rotating display

Alan Knowler,
Gillingham,
Kent.

ZX-81

THIS PROGRAM FOR THE ZX-81 with at least 16K will allow pages of information to be entered, which will be Poked into the Rem statement and together with a machine-code routine will rotate through the display, printing to the screen with the speed of machine code. Entering the program is divided into three main parts:

- Entering the Rem statement.
- Entering and running the hex-loader.
- Entering and running the screen display loader.

The final program will be totally in machine code with a couple of lines of Basic to run it.

Stage 1 — entering the Rem statement: on a 16K machine up to 19 pages can be displayed. If all 19 pages are wanted the Rem has to be roughly 13,600 bytes long. An easy way of entering this is to Load a program from tape that uses most of the 16K, then use the Automatic Rem published in *Your Computer* Software File, September 1982 by K Young to change it to a massive Rem.

When this is Run enter 13600 to the prompt. Once this has been entered, as a direct command enter

POKE 16510,0

to make the first line of the program 0. If you have trouble with line 0 returning to the screen then

POKE 16419,10 LIST 10

as direct commands.

Stage 2 — entering and running the hex loader — figure 2. When this is run enter the hexadecimal numbers missing out the spaces for example:

7676E17E23 NEWLINE

etc. When completed press Newline and the program will stop with an error message. Delete the loader — line by line.

Stage 3 — entering and running the screen display loader — figure 3. Enter the loader, before running it, save it on tape. Although the program is in Basic it Pokes into video RAM and the program may crash if incorrectly entered.

When Run an inverse '?' will be displayed in the top-left corner of the screen. If a key is pressed the appropriate character will take its place and it will move on to the next print position. If a space is wanted press Newline as the normal space key will break out of the program. To rub out a character press shift 0 as in normal Basic. If a key is pressed for a short time one character is printed. If a key is held down the character will be printed repeatedly.

Inverse Character Mode — to print inverse characters press shift 8, inverse '?' will become inverse 'I'.

To return to inverse '?' press shift 8 again.

Graphic Character Mode — to print graphics press shift 9. The inverse '?' will become inverse 'G'. The keys 1 to 0 represent the first 10 characters of the character set — see appendix A of the Sinclair manual. Press shift 9 to return you to inverse '?'.

When each screen is completed there is a short pause — lines 4040 and 4510. You are asked if you have finished. If you have then press Y and the program will stop. Pressing N and the program will continue to the next page.

If you answered Y then the program has been completed. Add these lines:

```
9998 RAND USR 16542
9999 GOTO 9998
RUN 9998
```

To break out of the display press the break key at the end of the loop of pages.

If you wish to use the two lines at the bottom of the screen — lines 23 and 24 — before running the screen display loader change line 210 to

```
210 IF C>768 THEN . . .
```

And before running the final program add

```
9997 POKE 16418,0
```

To run the program with the extended screen use Run 9997.

To alter the time each page is on the screen Poke 16529,n where n is any number from 1 to 255. 1 is just under a second, 255 is approximately 1 minute 45 seconds.

To run through the display once, remove line 9999.

Figure 1. Automatic Rem.

```
9000 PRINT "HOW MANY BYTES REQUI
RED?"
9010 INPUT N
9020 LET L1=PEEK 16511+256*PEEK
16512
9030 LET L2=PEEK (L1+16515)+256*
PEEK (L1+16516)
9040 LET L3=L1+L2+4
9050 LET X=INT (L3/256)
9060 POKE 16511,L3-256*X
9070 POKE 16512,X
9080 POKE L1+16512,0
9090 IF L1+L2+2<N THEN GOTO 9020
9100 POKE 16514,118
9110 POKE 16515,118
9120 PRINT "REM LENGTH =";L3-2;"
 BYTES"
```

Figure 2 The hex loader.

```
 0 REM MACHINE CODE STORED IN
       LINE 0
10 LET A=16514
20 LET A$=""
30 IF A$="" THEN INPUT A$
40 POKE A,16*CODE A$+CODE A$(2
)-476
50 SCROLL
60 PRINT A,A$(1 TO 2)
70 LET A$=A$(3 TO )
80 LET A=A+1
90 GOTO 30
```

```
HEX DUMP FOR THE ABOVE LOADER
ADDRESS      HEXADECIMAL

16514   76 76 E1 7E 23 E5 FE FF

16522   C8 CD 06 08 18 F4 06 05

16530   11 FF FF 21 32 37 19 38

16538   FD 10 F8 C9
```

Figure 3. Screen display loader.

```
 0 REM
10 LET A=16542
11 LET G=0
```

(continued on page 181)

IMPACT SOFTWEAR

ZX Spectrum, VIC 20 Dragon 32 & now also

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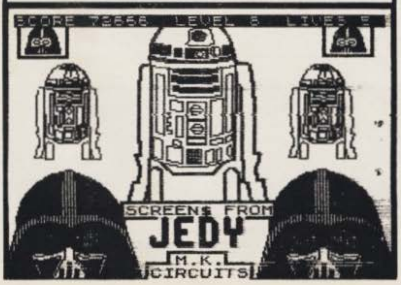

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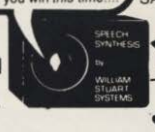

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(continued from page 181)

```
660 SOUND 20,2
670 PRINT@485,"press";CHR$(128);"any";CHR$(128);"key";
CHR$(128);"to";CHR$(128);"play";
680 FOR D=1TO300:NEXT
690 SOUND 100,2
700 IF A$<>""THEN 70
710 GOTO630
720 CLS:PRINT"INSTRUCTIONS"
730 PRINT"RATTS IS A 2 PLAYER GAME WHERE  YOU MOVE ABO
UT THE SCREEN,TRYINGTO AVOID THE TRAILS OF YOU AND  YO
UR OPPONENT."
740 PRINT"WHEN YOU HIT EITHER TRAIL YOUR  OPPONENT SCO
RES 1 POINT."
750 PRINT"   LEFT";STRING$(8,32);"RIGHT"
760 PRINT" CONTROLS      CONTROLS"
770 PRINT:PRINT"          UP-^          UP-P"
780 PRINT"   DOWN-C.DOWN  DOWN-;"
790 PRINT"   LEFT-A       LEFT-_"
800 PRINT"  RIGHT-S      RIGHT-C.RIGHT"
810 GOTO630
```

Bomber

Shingo Sugiura,
Putney,
London.

BBC

IF YOU HAVE PLAYED or seen any of the Acornsoft games I'm sure you admire the multicolour graphics and the super smooth animation. I have written a simple game based on the traditional Blitz, to show how multicoloured characters can be moved around the screen and to show how it can add that professional touch to simple games like this one.

The program also shows how directly Poking the screen is faster than printing. This is not recommended by Acorn who says that it makes programs incompatible with the Tube but you cannot use anything on the Tube at the moment — and on Acorn's past record of bringing out peripherals for the BBC it will probably take a bit of time for the long-awaited second processor to appear on the market.

Another advantage is that you are not restricted to a certain number of characters but you can have as many multicoloured characters as the memory allows.

The game can be improved in many ways — missiles from the tops of the buildings, fuel, ability to gain altitude, more than one life, more than one bomb allowed on the screen at once and so on. Let your imagination run wild and you could end up with a totally new and exciting game.

The program is very well structured and is therefore very readable. In fact, the program does not contain a single Goto or Gosub statement.

Lines	
10	Traps errors.
20	Selects Mode 7 and prints instructions.
30	Defines characters and envelope.
40	Selects Mode 2, sets background colour to cyan and gets rid of flashing cursor.
50	Assembles machine code and data for the multicoloured characters.
60 to 90	Main loop.
110 to 240	The actual game.
260 to 280	A simple delay procedure.
300 to 400	A procedure to build the buildings.
420 to 450	Initialise variables.
470 to 650	Data for characters.
600 to 1050	Machine code.
1080 to 1150	Procedure called on landing.
1170 to 1220	Defines characters.
1230	Envelope.
1260 to 1440	Instructions.

```
  1REM ***************************
  2REM ***          BOMBER       ***
  3REM **  By Shingo Sugiura     **
  4REM ***  (C) JULY  1983      ***
  5REM ***************************
  6 REM FOR £ READ HASH CHARACTER
 10ON ERROR RUN
 20MODE7:PROCinst
 30PROCdefine
 40MODE2:VDU17,134,12,23;10,32;0;0;0;
 50PROCass
 60REPEAT
 70PROCinit
 80PROCgame
 90UNTIL FALSE
100
110DEFPROCgame
120CLS
130PROCbuild
140REPEAT
150CALL drplane
160SOUND&10,-10,6,1
170IF INKEY(-99) AND ?bomb=0 AND ?flag=0 CALL fire
180PROCwait(del)
190CALL drop
200UNTIL ?crash=1 OR ?landed=1
210IF ?crash=1 THEN SOUND0,2,6,10 ELSE PROClanded
220PRINTTAB(0,1)"Press S to replay";
230REPEAT UNTIL GET=83
240ENDPROC
250
260DEFPROCwait(T)
270FOR delay%=0 TO T:NEXT delay%
280ENDPROC
290
300DEFPROCbuild
310FOR build%=1 TO 18
320char=RND(2)+224
330VDU17,2,31,build%,30,224
340FOR height%=29 TO RND(20)+dif*2 STEP-1
350VDU17,0,31,build%,height%,char
360NEXT height%
370VDU31,build%,height%+1,char+2
380SOUND1,-15,RND(200),1
390NEXT build%
400ENDPROC
410
420DEFPROCinit
430!pos1=&3000:?crash=0
440?bomb=0:?flag=0:?landed=0
450ENDPROC
460
470DEFPROCass
480pos1=&70:pos2=&72:crash=&74
490bomb=&76:flag=&77:landed=&78
500DIM plane 96,Bomb 32,code 110
510FOR A=plane TO plane+63:READ B:?A=B:NEXT A
520DATA60,22,3,3,3,3,3,60
530DATA60,60,60,22,3,3,3,56
540DATA41,60,60,41,3,23,3,60
550DATA3,40,40,3,3,23,3,60
560DATA3,60,60,3,3,23,3,60
570DATA3,40,40,3,3,23,3,56
580DATA3,60,60,22,3,3,22,60
590DATA60,60,60,60,0,60,60,60
600FOR A=Bomb TO Bomb+31:READ B:?A=B:NEXT
610DATA45,45,60,60,57,57,57,60
620DATA40,15,15,51,51,51,51,51
630DATA20,15,15,51,51,51,51,51
640DATA30,30,60,60,54,54,54,60
650FOR PASS=0 TO 2 STEP 2:P%=code
660[OPT PASS
670.drplane
680LDY£31
690.loop1
700LDA£60:STA (pos1),Y
710DEY:BPL loop1
720CLC:LDA pos1:ADC£32:STA pos1:LDA pos1+1:ADC£0:STA
pos1+1
730LDY£63:LDA (pos1),Y:CMP£60:BEQ cont
740LDA£&1:STA crash
750.cont
760LDY£63
770.loop2
780LDA plane,Y:STA (pos1),Y
790DEY:BPL loop2
800LDA pos1+1:CMP£&7A:BPL end1
810RTS
820.end1
830LDA£1:STA landed
840RTS
850.fire
860SEC:LDA pos1:SBC£&80:STA pos2:LDA pos1+1:SBC£2:ST
A pos2+1
870LDA£1:STA bomb
880RTS
890.drop
900LDA bomb:BNE cont2
910RTS
920.cont2
930LDY£31
940.loop3
950LDA£60:STA (pos2),Y:DEY:BPL loop3
960CLC:LDA pos2:ADC£&80:STA pos2:LDA pos2+1:ADC£2:ST
A pos2+1
```

(continued on next page)

(continued from previous page)

```
 970LDA pos2+1:CMP £&7B:BPL end
 980LDY£31
 990.loop4
1000LDA Bomb,Y:STA (pos2),Y
1010DEY:BPL loop4
1020RTS
1030.end
1040LDA£0:STA bomb:RTS
1050]NEXT PASS
1060ENDPROC
1070
1080DEFPROClanded:RESTORE1140
1090FOR music=1 TO 10
1100READ A,B:SOUND1,-10,A,B:SOUND2,-10,A,B:SOUND3,-10
,A,B
1110NEXT music
1120PRINTTAB(0,0)"Well Done.You landed."
1130ENDPROC
1140DATA 129,9,117,4,121,4,129,9,101,9
1150DATA 121,4,129,4,137,4,145,4,149,4
1160
1170DEFPROCdefine
1180VDU23,224,255,255,255,255,255,255,255,255
1190VDU23,225,254,146,254,146,254,146,254,146
1200VDU23,226,254,198,254,198,254,198,254,198
1210VDU23,227,16,16,56,68,254,146,254,146
1220VDU23,228,0,16,16,16,56,108,254,198
1230ENVELOPE2,4, 0,0,0,1,1,1, 126,-4,-1,-4, 126,80
1240ENDPROC
1250
1260DEFPROCinst
1270PRINTTAB(13);CHR$141CHR$131;"BOMBER"
1280PRINTTAB(13);CHR$141CHR$131;"BOMBER"
1290PRINT'TAB(9)CHR$130;"By Shingo Sugiura"
1300PRINT'" You are on board a decrepit plane"
1310PRINT"desperately short of fuel and rapidly"
1320PRINT"losing altitude. Your only hope is"
1330PRINT"to demolish the buildings below by"
1340PRINT"dropping bombs to make way for your"
1350PRINT"plane to land."
1360PRINT'CHR$129;"To release bomb press SPACE"
1370PRINT'CHR$134"  Press ESCAPE to return to menu"
1380PRINT''CHR$133;"Input difficulty(1 hard to 9 easy
) ";
1390REPEAT dif=INSTR("123456789",GET$):UNTIL dif:PRIN
T;dif
1400PRINT'CHR$133;"Input speed(0 fast to 9 slow) ";
1410REPEAT del=INSTR("0123456789",GET$):UNTIL del:PRI
NT;del-1:del=(del-1)*15
1420PRINT''TAB(6);CHR$129;"Press SPACE BAR to play.";
1430REPEAT UNTIL GET=32
1440ENDPROC
```

Alien flashers

Campbell Wilson, Thurso, Caithness.

VIC-20

NOT DIRTY OLD Martians I'm afraid, but yet another invasion game. This program uses multicolour and user-defined graphics to good effect, as well as a machine-code routine to enhance explosions.

Instructions are included in the program and are quite straightforward. To score a high score requires a few games to work out the strategy. On destroying a wave of invaders, the initial number of which is input at the start — up to 30 — the player is then confronted with a new wave of invaders, which will have increased in number by five — maximum 30. For each wave destroyed without losing a laser base, the bonus is doubled, but is reset if any aliens manage to pass your defences and so destroy your laser base. You start with three laser bases.

Some variables can be altered in the program to vary the game:

LB — number of laser bases
EX — bonus at start
SC — score — alters at line 160
G — top left of screen } Alter for
G+C — start of colour memory } expanded Vics.

```
  1 CLR:GOTO500
  2 PRINT"□SETTING UP GRAPHICS":POKE36879,15:POKE650,255
 10 FORE2,28:POKE56,28:CLR:FORI=7168TO7679:POKEI,PEEK(I+25600):NEXT
 12 DIMZX(30),PX(30),OX(30)
 14 FORI=1TO30:ZX(I)=0:PX(I)=0:OX(I)=0:NEXT:C=0:NV=0:V=36878 :G=0:F=0
 15 POKE36869,255:FORI=673TO708:READR:POKEI,R:NEXT
 20 FORI=7384TO715:READBP:POKEI,BP:NEXT
 21 DATA169,0,168,133,252,169,30,133,253,177,252,24,105,128,145,252,166,252
 22 DATA232,208,2,230,253,134,252,224,250,208,236,166,253,224,31,208,230,96
 24 DATA40,170,190,190,170,40,130,65,165,90,165,66,129,34,89,149
 25 DATA24,24,24,153,255,219,129,129,9,144,9,144,9,144,9,144
 30 SC=0:LB=3:EX=50
 35 POKEV,95:PRINT"□"
 36 FORI=1TO5:READSN,DU:FORT=1TODU:POKE36876,SN:NEXT:NEXT:POKE36876,0
 37 DATA201,40,207,40,195,40,135,40,175,80
 40 INPUT"HOW MANY INVADERS";NV
 42 IFNV>30THENPRINT"NO MORE THAN 30":GOTO40
 47 T=0:C=30720:G=8174:V=36878:S=36877:S1=36876:H=0:CS=36879
 50 Z%(0)=7724:PRINT"□":POKECS,15
 55 FORI=1TONV:PX(I)=27:OX(I)=12:ZX(I)=Z%(I-1)+4:POKEZX(I),PX(I):POKEZX(I)+C,OX(
I):NEXT
 60 POKEG,29:POKEG+C,5
 100 PRINT"□SCORE"SC:POKEV,80:POKES,0 POKES1,0
 101 IFLB=1GOTO200
 102 FORI=1TOLB#2-2STEP2:POKE7693+I,29:POKEI+C+7693,5:NEXT:GOTO200
 110 K=PEEK(197):IFK=64THEN100
 111 IFK=32THENX=1
 112 IFK=29ORK=37THENX=2
 114 ONXGOTO115,120
 115 F=1:POKEV,95
 116 POKEG-22#F,30:POKEG-22#F+C,7:POKEG-22#F+22,32:POKEG,29:POKEG+C,5
 117 IFPEEK(G-22#F-22)=27THEN150
 118 POKES,240:F=F+1:IFF=24THEN100
 119 GOTO116
 120 POKEG,32:G=G-(K=29)*(G>8165)+(K=37)*(G<8184):POKEG,29:POKEG+C,5:GOTO100
 150 POKEG-22#F-22,28:POKEG-22#F-22+C,7:POKEG-22#F,32:POKEG-22#F+C,0:POKE36879,4
2
 151 FORI=239TO135STEP-8:POKES1,I:SYS(673):NEXT:POKES1,0:POKEV,80
 152 POKECS,15:FORI=1TONV:IFZX(I)<G-22#F-22THEN155
 153 PX(I)=32:OX(I)=8:POKEZX(I),PX(I):POKEZX(I)+C,OX(I)
 155 NEXT
 160 SC=SC+INT(60/NV):PRINT"□SCORE"SC:H=H+1:IFH=NVTHEN305
 162 GOTO100
 200 I=INT(RND(1)#NV)+1:IFPX(I)=32THEN200
 202 M=INT(RND(1)#3)+21 IFPEEK(ZX(I)+M)=27THEN200
 203 POKEV,10+INT(RND(1)#16)#16:FORT=1TO15:POKES,238:NEXT
 204 POKEZX(I),32:POKEZX(I)+C,8:ZX(I)=ZX(I)+M:IFZX(I)>8185THEN340
 206 POKEZX(I),PX(I):POKEZX(I)+C,OX(I)
 210 GOTO110
 305 PRINT"□□□□□□□□□□□□ATTACK WAVE DESTROYED□"
 306 EX=EX#2
 307 PRINT"□□□□BONUS"EX:SC=SC+EX
 310 FORT=1TO999:NEXT:I=0:GOTO346
 340 POKECS,59:FORE=15TO8STEP-.5:POKEV,E:POKES,135:POKEG,29:POKEG+C,5:SYS673
 341 POKEG,28:POKEG+C,2:SYS673:NEXT
 343 LB=LB-1:IFLB=0THEN350
 344 EX=50
 345 POKECS,127:PRINT"□□□□□□□□□□□LASER BASE DESTROYED□":FORT=1TO999:NEXT
 346 NV=NV+5:IFNV>30THENNV=30
 347 GOTO47
 350 POKECS,42:PRINT"□□□□□□□□□□□OVERRUN!) SCORE"SC:POKEV,15
 360 FORL=1TO15:POKES-1,INT(RND(1)#128)+128:FORM=1TO10:POKECS,76:NEXT:POKECS,77:
NEXT
 361 POKEV,0:POKES-1,0:POKE198,0
 365 FORT=1TO3000:NEXT
 370 PRINT"□□□□□□□□□ANOTHER GAME(Y/N) "
 380 GETA#:IFA#="T"THEN380
 381 IFA#="Y"THENPOKES,0:GOTO1
 382 IFA#<>"N"THEN380
 383 POKE650,0:POKECS,27:PRINT"□□":POKE36869,240:END
 500 PRINT"□":POKE36879,93
 510 PRINT"□□□□□ALIEN FLASHERS□"
 511 PRINT"□□DESTROY ONCOMING ALIEN  HORDES BEFORE THEY   OVERRUN YOUR BASE"
 512 PRINT"□□IF THE ENEMY FLEET IS FEW IN NUMBER THEY AREHARDER TO DESTROY "
 514 PRINT"BUT WORTH MORE POINTS"
 516 PRINT"□□□□□□□□CONTROLS□"
 518 PRINT"□□K□ LEFT                    S□ RIGHT"
 519 PRINT"□□□□SPACE BAR,FIRE"
 520 PRINT"□□□□□HIT ANY KEY□"
 550 GETA#:IFA#<>""THEN2
 552 GOTO550
```

User-defined keys

John Burton, Rugby, Warwickshire.

SPECTRUM

THIS PROGRAM FOR the 48K Spectrum provides 33 user-defined function keys which are used in a similar way to those on the BBC Micro.

Because there are no unused keys on the Spectrum keyboard, a new shift key is used to access them. The Space key is used in the same way as the two existing shift keys. It, and any other key pressed together will produce the required line in the edit/input area at the bottom of the screen. For example, if the H

(continued on page 191)

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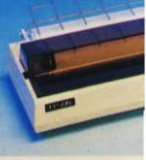

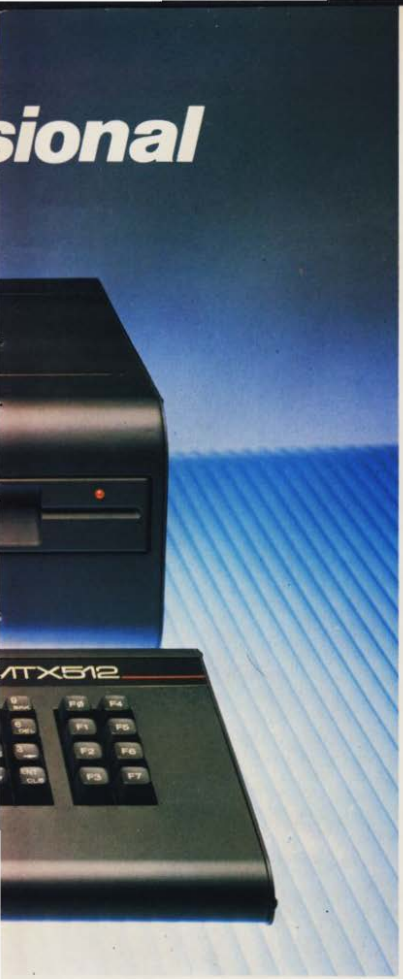

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The MTX's 24K ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, MTX LOGO commands, NODDY. ROM routines include an ASSSEMBLER/DISASSEMBLER with screen display of the Z80 CPU registers, memory and program,which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to split the screen into a maximum of eight sections to work independently whilst maintaining all full screen facilities. Pascal is available as an add-on ROM pack.

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The MTX500 has 32K of user RAM as standard (64K on the 512), expandable to 512K plus 16K of video RAM, controlled by a separate Video Processor. Sixteen colours, 40 column text, 256 x 192 high resolution graphics with all sixteen colours available, and 32 easily moveable user defined graphics characters (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are centronics printer port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port, separate TV and Video Monitor ports, 4 channel sound with hifi output plus a dedicated cartridge port. Other standard features include the Z80A processor running at 4MHz, real time clock, full moving key keyboard with 79 keys including eight 2-function keys and separate numeric pad.

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key was programmed with:

BORDER 7 : PAPER 7 : INK 0 : CLS

Pressing Space and H together will produce that line when the next key is pressed.

Programming the keys is usually only done when the program to set up the machine code is run, but could be done using Poke also.

After program 1 is entered, key definitions should be entered from line 3000 onwards. This should have the code for each keyword or letter or symbol with the last one being zero. For example the line shown above would be:

3000 DATA 231, 55, 58, 218, 55, 58, 217, 48 0

where 231 is the code for border, 55 the code for 7, and 58 the code for : and so on.

The first Data line after 3000 will define key H, the second will define Y and the third 6. The sequence is:

H Y 6 5 T I G V (N) J U 7 4 R F C (M)

and so on.

The letters in brackets cannot be programed but must still be given the code 0 in the Data lines.

The codes are put in the area of memory from 6032 on with each key having 32 bytes.

The machine code uses interrupts and so cannot be used with another program that does so also. Examples of key definitions:

Key H : LOAD " " : RUN
Key Y : PLOT 0,0 : DRAW 255,0 : DRAW 0,175 : DRAW -255,0 : DRAW 0, -175
Key 6 : -not used
Key 5 : Print 0;
Key T : Plot 55, 27 : DRAW 50, 50, 105*PI
Key 6 : RANDOMISE 0

The data lines for these are:

```
3000 DATA 239, 34, 34, 58, 247, 0
3001 DATA 246, 48, 44, 48, 58, 252, 50, 53, 53,
  44, 48, 58, 252, 48, 44, 49, 55, 53, 58, 252, 45,
  50, 53, 53, 44, 48, 58, 252, 48, 44, 45, 49, 55,
  53, 0
3002 DATA 245, 35, 48, 59, 0
3003 DATA 246, 53, 53, 44, 50, 55, 58, 252, 53,
  48, 44, 53, 48, 44, 49, 48, 53, 42, 167, 0
3004 DATA 249, 48, 0
```

To use the program:

1. Type in program one
2. Type in key definitions from line 3000
3. RUN the program
4. Type RANDOMISE USR 65122

Step 4 should be used to re-activate the interupts whenever New is used.

The program should be saved to tape after step 2 with

SAVE "USER KEYS"

Once all the steps have been followed, the program and key definitions can be saved with:

SAVE "USER CODE" CODE 60000, 5535

To load back type:

1. Clear 59999
2. LOAD "USER CODE" CODE
3. RANDOMISE USR 65122

```
10 DATA 62,9,237,71,237,94,201,255,243,229
20 DATA 213,197,245,205,142,2,62,32,186
30 DATA 194,153,254,38,0,107,41,41,41,41
40 DATA 41,17,96,234,25,126,254,0,40,8
50 DATA 35,229,205,129,15,225,24,243
60 DATA 205,142,2,62,32,187,32,248,241,193
70 DATA 209,225,251,201
80 DATA -1
999 CLEAR 59999
1000 LET cs=0: FOR a=65122 TO 1E5
1010 READ z: LET cs=cs+z: IF z=-1 THEN GO TO 2000
1020 POKE a,z
1030 NEXT a
2000 IF cs<>8007 THEN PRINT FLASH 1;"DATA ERROR IN LINES 10
TO 80": STOP
2001 FOR a=60032 TO 1E5: READ z: IF z<>0 THEN POKE a,z: NEXT
a
2010 IF (a-59999)/32=INT ((a-59999)/32) THEN NEXT a
2020 LET a=a+1: POKE a-1,0: GO TO 2010
```

Sea-Fox

Jason Bell,
Prestwood,
Buckinghamshire.

ATARI

YOU PLAY THE ROLE of a submarine lurking beneath the surface of the water. In the shipping lanes in the distance, tankers, destroyers, aircraft carriers and other various ships pass by at different speeds. You score points by sinking these ships with your torpedoes, and you score bonus points depending on the ship's speed and distance from the submarine.

Use the joystick — in the left most socket — to move your sub left and right. Press the trigger button to launch a torpedo. Initially, you have one minute to score as many points as you can. If you manage to score 1,000 points in the first minute, then you get 30 seconds of extra playing time. From then on, you must score another 500 points to win more time — 30 seconds. When the time counter reaches zero, the game is over.

If you get one of the top five scores, you then have the chance to enter your name into the high-score table. You can use up to seven letters, but the computer will only accept upper case, normal video letters, so do not press the Atari logo and lower-case keys.

All movement in Sea-Fox is achieved by a vertical blank interrupt, VBI, routine in conjunction with player-missile graphics. The vertical blank period occurs every 1/60th of a second after the screen has been drawn. Therefore, whatever happens in a VBI routine, it occurs every 1/60th of a second, regardless of most other operations. This is often known as multi-processing.

In Sea-Fox, a VBI routine gives fast, smooth movement. The routine performs three main functions: it moves the ships, submarine and missile. The routine uses page 6 — locations 0600-06FF hex, 1536-1791 decimal — to hold variables which the routine uses:

1536 to 1538	Horizontal positions of players 0-2 — ships.
1540 to 1542	Speeds of players 0-2.
1544 to 1546	Directions of players 0-2.
1548	Horizontal position, submarine — player 3.
1550	Missile yes/no flag: 1 = yes, 0 = no.
1551	Vertical position, missile 3 — torpedo.
1552	Missile speed.

The ship speeds vary from 0 to 3 — 0 only when the ship is being exploded. The speed is simply the number of times a left/right is performed in the VBI routine. Your submarine travels at speed 2. The directions are 1 for right and 255 for left. In the routine, these values are added to the horizontal position values, which gives the desired result. The missile speed is initially set to 5, although this can be changed by altering the 15th Data value in line 640.

The data for the VBI routine is held in VBI$. Another routine, which enables the VBI, is held in Setup$. The routine changes the deferred vertical blank vector — locations 0224 and 0225 hex — to point to my routine. This can only be done in machine language, and is performed by jumping to an operating system routine SETVBV, which starts at location 58460 — E45C hex.

Before jumping to the OS routine, the X-register is loaded with the high byte of the address of the VBI routine, and the Y-register is loaded with the low byte. The accumulator is then loaded with 6 for the immediate vector, or 7 for the deferred vector. I used the deferred vector.

The VBI is enabled by executing

X=USR(ADR(SETUP$))

By changing the two values loaded by the X and Y registers — the 3rd and 5th values of Setup$ — to 228 and 98 respectively, and executing the same command, the VBI can be disabled.

```
10 REM * Sea Fox. By J.Bell *
20 ? "INITIALIZING.."
30 DIM PM$(1):PM=PEEK(106)-16:ATAB=
PEEK(140)+256*PEEK(141):VTAB=PEEK(1
34)+256*PEEK(135)
40 OFFSET=PM*256-ATAB:HI=INT(OFFSET
/256):LO=OFFSET-HI*256
50 POKE VTAB+2,LO:POKE VTAB+3,HI:PO
KE VTAB+4,0:POKE VTAB+5,8:POKE VTAB
+6,0:POKE VTAB+7,8
60 DIM SETUP$(11):FOR X=1 TO 11:REA
D A:SETUP$(X)=CHR$(A):NEXT X
70 DATA 104,160,0,162,0,169,7,32,92
,228,96
80 DIM VBI$(152):A=ADR(VBI$):HI=INT
(A/256):LO=A-HI*256:POKE ADR(SETUP$
)+2,LO:POKE ADR(SETUP$)+4,HI
90 FOR X=1 TO 152:READ A:IF A=77 TH
EN A=PM+3
100 VBI$(X)=CHR$(A):NEXT X
110 DATA 169,0,168,216,190,4,6,185,
0,6,201,20,240,17,201,225,240,13,24
,121,8,6,153,0,6,153,0,208,202,208,
232
115 DATA 200,192,3
120 DATA 208,224,160,2,174,12,6,173
,120,2,201,11,208,5,224,48,240,10,2
02,201,7,208,5,224,200,240,1,232,14
2,12,6,142,3
130 DATA 208,136,208,223,173,16,6,2
40,52,174,14,6,240,47,172,15,6,192,
32,240,40,138,72,136,140,15,6,162,4
,169,64,153
140 DATA 0,77,200,202,208,249,169,0
,153,0,77,173,3,208,208,28,173,11,2
08,208,11,140,0,210,104,170,202,208
,209
145 DATA 76,98,228,160,255
```

(continued on page 194)

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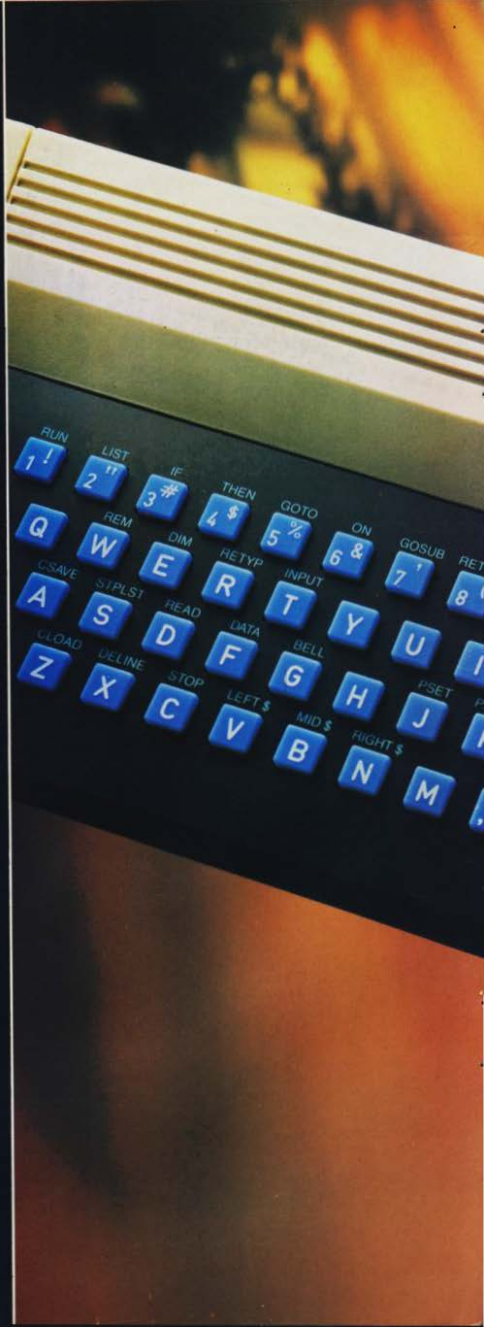

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SOFTWARE FILE

(continued from page 191)

```
150 DATA 200,24,106,144,251,169,0,1
53,8,6,169,0,141,14,6,104,76,98,228
160 DIM SUB$(9):FOR X=1 TO 9:READ A
:SUB$(X)=CHR$(A):NEXT X
170 DATA 8,24,24,24,60,126,255,254,
124
180 DIM SHIP$(168):FOR X=1 TO 168:R
EAD A:SHIP$(X)=CHR$(A):NEXT X
190 DATA 0,0,0,0,0,0,16,24,24,60,63
,255,254,252,0,0,0,0,0,0,8,24,24,60
,252,127,63
200 DATA 0,0,0,0,0,0,16,16,24,60,12
4,255,254,124,0,0,0,0,0,0,8,8,24,60
,62,255,127,62
210 DATA 0,0,0,0,16,48,48,48,48,63,
255,255,126,60,0,0,0,0,8,12,12,12,1
2,252,255,255,126,60
220 DATA 0,0,0,0,32,32,96,96,102,11
8,255,255,126,60,0,0,0,0,4,4,6,6,10
2,110,255,255,126,60
230 DATA 0,0,0,16,16,48,48,56,124,1
20,254,254,252,120,0,0,0,8,8,12,12,
28,62,30,127,127,63,30
240 DATA 16,16,16,16,24,56,120,124,
254,255,255,254,124,120,8,8,8,8,24,
28,30,62,127,255,255,127,62,30
250 DIM MD$(5):FOR X=0 TO 5:READ M=M
D(X)=M:NEXT X
260 DATA 0,0,1,1,1,1
270 DIM CL$(14):FOR X=1 TO 14:CL$(X
)=CHR$(0):NEXT X
280 DIM HSC$(65):FOR X=0 TO 4:HSC$(
X#13+1,(X+1)#13)="ATARI  00500":NE
XT X
290 DIM COL$(20):FOR X=1 TO 20:READ
 A:COL$(X)=CHR$(A):NEXT X
300 DATA 24,60,218,70,90,186,72,152
,54,232,74,168,88,154,24,252,200,76
,230,26
310 FOR X=0 TO 10:READ A:POKE 1568+
X,A:NEXT X
320 DATA 72,169,52,141,10,212,141,2
6,208,104,64
330 DIM S$(5),T$(2):OPEN #1,4,0,"K:
":S$="00000"
340 GRAPHICS 21:POKE 559,62:POKE 62
3,1:POKE 54279,PM:POKE 53277,3
350 DIM Y(2),E(2),EXPL$(14),SN(2),S
P(2),H(2),BV(5),N$(7)
360 FOR X=0 TO 5:READ A:BV(X)=A:NEX
T X
370 DATA 17,20,8,5,11,3
380 FOR X=1 TO 14:READ A:EXPL$(X)=C
HR$(A):NEXT X
390 DATA 33,34,150,84,57,30,60,123,
159,30,52,86,151,36
400 D=PEEK(560)+256#PEEK(561):SC=PE
EK(D+4)+256#PEEK(D+5)+640:POKE D+3,
77
410 FOR X=6 TO 20:POKE D+X,13:NEXT
X:POKE D+21,7:POKE D+22,61:POKE D+23
,7:FOR X=24 TO 32:POKE D+X,6:NEXT X
420 POKE D+33,7:POKE D+34,154:POKE
D+35,6:POKE D+36,7:POKE D+37,65:POK
E D+38,PEEK(560):POKE D+39,PEEK(561
)
430 POKE 512,32:POKE 513,6:POKE 542
86,192:POKE 708,10:POKE 709,238:POK
E 710,184:POKE 711,40:POKE 712,98
440 POKE 87,7:COLOR 3:FOR X=1 TO 53
:READ Y:PLOT 50+X,10:DRAWTO 50+X,10
-Y:NEXT X
450 DATA 0,0,0,0,1,1,2,2,4,4,5,3,1,
0,1,2,1,0,1,3,5,4,3,1,2,4,3,3,3,3,3
,2,2,2,2,2,2,2,2,2,2,1,1,0,0,0,0,
0,0,0,0
460 COLOR 1:PLOT 86,1:DRAWTO 86,7:P
LOT 87,0:PLOT 88,0:PLOT 89,1:DRAWTO
 89,7:PLOT 87,3:DRAWTO 87,6:PLOT 88
,3:PLOT 88,5
470 DRAWTO 88,7:COLOR 2:PLOT 87,1:P
LOT 88,1:PLOT 88,2:PLOT 87,2:COLOR
3
480 DATA 0,1,1,1,2,4,3,5,4,4,3,2,2,
1,1,0
490 FOR X=1 TO 16:READ Y:PLOT 120+X
,12:DRAWTO 120+X,12-Y:NEXT X
500 DATA 0,1,2,3,1,0,0,1,1,2,3,5,4,
3,1,0
510 FOR X=1 TO 16:READ Y:PLOT 10+X,
12:DRAWTO 10+X,12-Y:NEXT X
520 H=INT(SC/256):L=SC-H#256:POKE 8
8,L:POKE 89,H:POKE 87,1
530 POSITION 4,0:? #6;"# sea  fox #
"
540 POSITION 4,2:? #6;"high scores:
"
550 FOR X=0 TO 4:POSITION 0,4+X:? #
6;"# ";X+1;". ";HSC$(X#13+1,(X+1)#1
3);" #";NEXT X
555 POSITION 2,10:? #6;"last score:
";S$
560 POSITION 0,12:? #6;"press START
 to play":GOSUB 1230
570 POSITION 6,12:? #6;"START":FOR
X=1 TO 25:IF PEEK(53279)=6 THEN 590
580 NEXT X:POSITION 6,12:? #6;"star
t":FOR X=1 TO 25:IF PEEK(53279)<6
THEN NEXT X:GOTO 570
590 TRAP 595:? #6;")"
595 GOSUB 1230
600 FOR X=0 TO 3:POKE 53248+X,0:NEX
T X:POKE 53278,0
610 S=0:S$="00000":T=0:TI=60:T$="60
":BONUS=1000:E(0)=0:E(1)=0:E(2)=0:P
M$(1)="":PM$(2048)="":PM$(2)=PM$:N=
0
620 Y(0)=1072:Y(1)=1360:Y(2)=1664:P
OKE 707,8:PM$(1983,1991)=SUB$
630 RESTORE 630:FOR X=0 TO 16:READ
A:POKE 1536+X,A:NEXT X
640 DATA 224,21,224,0,1,1,2,0,255,1
,255,0,124,0,5,186,0
650 FOR X=0 TO 2:GOSUB 790:NEXT X
660 POKE 53761,0
670 POKE ADR(SETUP$)+2,LO:POKE ADR(
SETUP$)+4,HI:X=USR(ADR(SETUP$)):POK
E 54286,192:POKE 19,0:POKE 20,0:POK
E 18,0
700 FOR X=0 TO 2:T=TI-INT((PEEK(20)
+256#PEEK(19)+65536#PEEK(18))/50):I
F T>0 THEN 970
710 T$="00":T$(3-LEN(STR$(T)),2)=ST
R$(T):POSITION 7,15:? #6;T$
715 IF STRIG(0)=0 THEN GOSUB 1200
720 IF PEEK(1536+X)=225 OR PEEK(153
6+X)=20 THEN GOSUB 790
730 A=PEEK(53259):IF A THEN GOSUB 8
90:GOSUB 900:POKE 53278,0
740 IF PEEK(53251) THEN GOSUB 890:P
OKE 53278,0
750 IF PEEK(1551)=32 THEN GOSUB 890
760 IF E(X) THEN GOSUB 910
770 IF STRIG(0)=0 THEN GOSUB 1200
780 NEXT X:GOTO 700
790 TRAP 1220:PM$(Y(X),Y(X)+13)=CL$
:A=PEEK(1544+X):POKE 1544+X,(255-A)
+1:IF RND(0)>0.5 THEN GOTO 860
800 IF Y(X)=1072 THEN Y(X)=1120:H(X
)=6:GOTO 860
810 IF Y(X)=1120 THEN Y(X)=1072:H(X
)=3:GOTO 860
820 IF Y(X)=1360 THEN Y(X)=1392:H(X
)=2:GOTO 860
830 IF Y(X)=1392 THEN Y(X)=1360:H(X
)=4:GOTO 860
840 IF Y(X)=1600 THEN Y(X)=1664:H(X
)=1:GOTO 860
850 IF Y(X)=1664 THEN Y(X)=1600:H(X
)=5
860 GOSUB 11B0:POKE 704+X,COL:SN(X)
=INT(RND(0)#6)#2:POKE 53256+X,WD(SN
(X)/2):IF PEEK(1544+X)=255 THEN SN(
X)=SN(X)+1
865 SP(X)=INT(RND(0)#3+1):POKE 1540
+X,SP(X):E(X)=0
870 PM$(Y(X),Y(X)+13)=SHIP$(SN(X)#1
4+1,(SN(X)+1)#14):IF PEEK(1536+X)=2
0 THEN POKE 1536+X,21:RETURN
880 POKE 1536+X,224:RETURN
890 POKE 1552,0:POKE 1550,5:PM$(768
+PEEK(1551),772+PEEK(1551))=CL$:POK
E 1551,186:POKE 53761,0:RETURN
900 N=INT(A/2):POKE 1544+N,0:IF E(N
) THEN RETURN
905 E(N)=1:PM$(Y(N),Y(N)+13)=EXPL$:
POKE 704+N,38:GOSUB 940:RETURN
910 E(X)=E(X)+1:IF E(X)=5 THEN GOTO
 930
920 POKE 704+X,PEEK(704+X)+8:SOUND
0,E(X)#50-50,8,8:SOUND 1,E(X)#50+50
,8,8:RETURN
930 N=INT(RND(0)#2):POKE 1536+X,20+
N#205:POKE 1544+X,1+N#254:POKE 5324
8+X,0:SOUND 0,0,0,0:SOUND 1,0,0,8:R
ETURN
940 A=INT(SN(N)/2):S=S+BV(A)+78#SP(N
)+5#H(N):S$(6-LEN(STR$(S)),5)=STR$(
S)
950 POSITION 0,15:? #6;S$:IF S>BONU
S THEN TI=TI+30:BONUS=BONUS+500
955 IF S$>HSC$(9,13) THEN POSITION
13,15:? #6;S$
960 RETURN
970 POKE ADR(SETUP$)+2,98:POKE ADR(
SETUP$)+4,228:X=USR(ADR(SETUP$)):PO
KE 54286,192
980 SOUND 0,0,0,0:SOUND 1,0,0,0:POS
ITION 7,15:? #6;"00"
990 FOR X=1 TO 5:POSITION 5,8:? #6;
"GAME  OVER":FOR T=1 TO 50:NEXT T
1000 POSITION 5,8:? #6;"GAME  OVER"
:FOR T=1 TO 50:NEXT T:NEXT X
1010 PM$(1)="":PM$(2048)="":PM$(2)=
PM$:POSITION 5,8:? #6;"              "
1020 FOR X=0 TO 4:SC=VAL(HSC$(X#13+
9,(X+1)#13)):IF S>SC THEN N=X:POP :
GOTO 1040
1030 NEXT X:GOTO 530
1040 FOR X=4 TO N+1 STEP -1:HSC$(X#
13+1,(X+1)#13)=HSC$((X-1)#13+1,X#13
):NEXT X
1050 POSITION 2,2:? #6;"CONGRATULAT
IONS!"
1060 POSITION 5,5:? #6;"your score"
:? #6;"  is one of the":? #6;"  to
p 5 of today!!"
1070 POSITION 2,10:? #6;"enter your
 name:"
1080 POSITION 6,12:? #6;"_":N$=""
1090 GET #1,K:IF K=155 THEN 1150
1100 IF K=126 AND LEN(N$)>1 THEN N$
=N$(1,LEN(N$)-1):GOTO 1120
1110 IF K=126 AND LEN(N$)=1 THEN N$
=""
1120 IF K>31 AND K<91 AND LEN(N$)<7
THEN N$(LEN(N$)+1)=CHR$(K)
1130 POSITION 6,12:? #6;N$;"_ "
1140 GOTO 1090
1150 HSC$(N#13+1,(N+1)#13)="
"
1160 HSC$(N#13+1,N#13+7)=N$:HSC$(N#
13+9,(N+1)#13)=S$:TRAP 1170:? #6;"
"
1170 GOSUB 1230:GOTO 530
1180 CL=CL+1:IF CL>20 THEN CL=1
1190 COL=ASC(COL$(CL)):RETURN
1200 IF PEEK(1552) THEN RETURN
1210 POKE 53761,138:POKE 53255,PEEK
(1548)+4:POKE 1552,1:RETURN
1220 POKE 1544+X,PEEK(1544+X)+1:GOT
O 790
1230 POSITION 0,14:? #6;"score time
 hi score00000  00    ";HSC$(9,13)
:RETURN
```

Floral carousel

James Greenall,
Bishop's Stortford,
Hertfordshire.

DRAGON

A PICTURE OF a flower is provided with this program. It rotates to the tune of *The Entertainer* — the theme from *The Sting*. This is done by drawing four flowers in different positions on the same axis on separate graphics pages and displaying them in rapid sequence.

10 to 370	Draw the four flowers.
1000 to 1030	Flick through the screens.
1015	Reads and plays the next note of the tune.
5000 and 5020	Contain the data for the tune.

```
5 PCLEAR8
10 PMODE2,1:PCLS
20 CIRCLE(75,65),60,,1,.93,.25
30 CIRCLE(127,35),60,,1,1/12,.43
40 CIRCLE(179,65),60,,1,.25,7/12
50 CIRCLE(179,125),60,,1,.43,.75
60 CIRCLE(127,155),60,,1,7/12,.93
70 CIRCLE(75,125),60,,1,.75,1/12
80 PAINT(127,40):PAINT(171,69):PAINT(172,120)
90 PAINT(127,145):PAINT(81,122):PAINT(81,68)
100 PMODE2,5:PCLS
110 CIRCLE(67,95),60,,1,5/6,1/6
120 CIRCLE(97,43),60,,1,0,1/3
130 CIRCLE(157,43),60,,1,1/6,.5
```

(continued on page 199)

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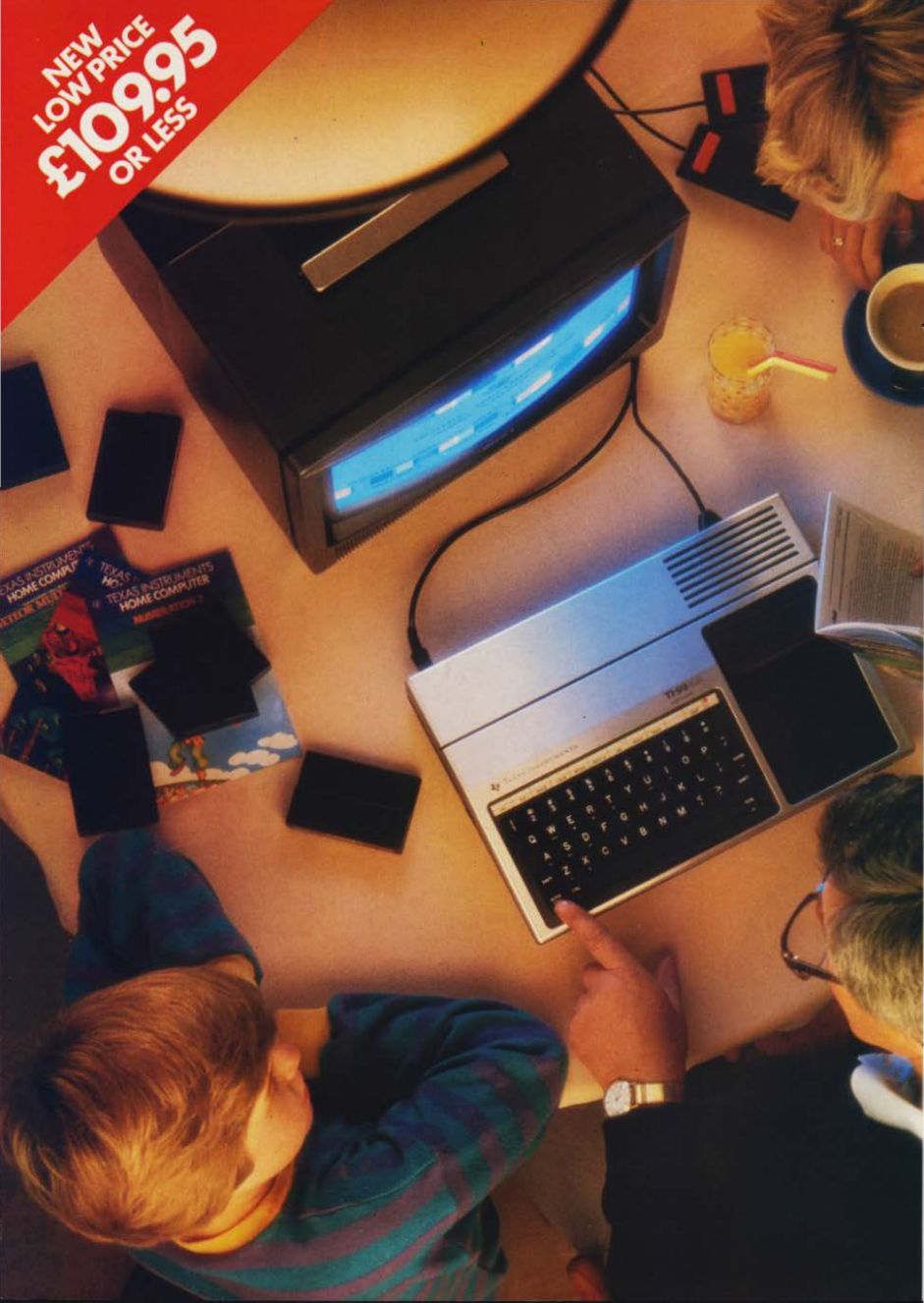
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(continued from page 194)

```
140 CIRCLE(187,95),60,,1,1/3,2/3
150 CIRCLE(157,147),60,,1,.5,5/6
160 CIRCLE(97,147),60,,1,2/3,1
170 PAINT(70,95):PAINT(100,49):PAINT(152,54):PAINT(183
,95):PAINT(152,137):PAINT(100,141)
200 PMODE2,3:PCLS
210 CIRCLE(111,37),60,,1,.05,.04167+1/3
220 CIRCLE(169,53),60,,1,.2083,.229+1/3
230 CIRCLE(185,111),60,,1,.375,.375+1/3
240 CIRCLE(143,153),60,,1,.55,.5417+1/3
250 CIRCLE(85,137),60,,1,.70833,.729+1/3
260 CIRCLE(69,79),60,,1,.875,.875+1/3
270 PAINT(114,46):PAINT(161,61):PAINT(176,108):PAINT(1
40,144):PAINT(93,129):PAINT(78,82)
300 PMODE2,7:PCLS
310 CIRCLE(85,53),60,,1,.955,.965+1/3
320 CIRCLE(143,37),60,,1,.125,.125+1/3
330 CIRCLE(185,79),60,,1,.3,.2917+1/3
340 CIRCLE(169,137),60,,1,.4583,.47+1/3
350 CIRCLE(111,153),60,,1,.625,.625+1/3
360 CIRCLE(69,111),60,,1,.8,.7917+1/3
370 PAINT(90,58):PAINT(140,46):PAINT(176,82):PAINT(160
,128):PAINT(114,144):PAINT(78,108)
1000 FORX=1TO79STEP2
1010 PMODE2,X:SCREEN1,1
1015 READ A$:PLAY "L6"+A$:IF A$="P4" THEN RESTORE
1020 NEXTX
1030 GOTO1000
5000 DATA03LBD,D£,E,04C,P8,03E,04C,03E,04C,C,C,C,C,P8,
C,D,D£,E,C,D,E,P8,03B,04D,P8,C,C,C,C,C,C,C,03D,D£,E,04C,
P8,03E,04C,P8,03E,04C,C,C,C,C,C,P8,03A,G,F£,A
5010 DATA 04C,E,P8,D,C,03A,04D,D,D,D,P8,P8,03D,D£,E,04
C,P8,03E,04C,P8,03E,04C,C,C,C,C,P8,C,D,D£,E,C,D,E,P8,D
3B,04D,P8,C,C,C,C,C,P8,C,D,E,C,D,E,P8,C,D,C,E
5020 DATA C,D,E,P8,C,D,C,E,C,D,E,P8,03B,04D,P8,C,C,C,C
,P4
```

Vduex

Adam Barnes,
Huntingdon,
Cambridgeshire.

BBC

VDUEX IS A PROGRAM I have written on a BBC Model B computer to add a range of new facilities to the VDU drivers. Although it will work on 16K micros, it entails the use of a graphics mode so after the memory used by VDUEX, not much will be left for your own programs.

VDUEX comes in two parts. The first part, when loaded, changes Page to make room for the machine code that will be assembled by part 2. I have organised it like this foreseeing that many people will wish to Chain the program at power on. It would therefore be sensible to set aside a cassette for VDUEX for convenience at the start of a session.

Typing VDUEX in is not a problem. Press Break and type in part 1. Save it at the beginning of the cassette. Press Break again and type Page=&1000, then type in part two and Run it. If you have typed in the program correctly you should see the assembly listing followed by a Press any key to engage VDUEX prompt. Doing this will result in an action identical to pressing the Break key. If everything is OK you will see:

```
BBC Computer
VDUEX - A Barnes
BASIC
```

with the usual prompt and cursor. If this does not happen you will need to make a hard reset — CTRL break, or rapid Break break on OS 0.1 — and type Page=&1000 and Old. Check the program — you will probably have made a minor mistake in typing in the assembly language. You should now Save the program on the cassette following part 1. You are now ready to test out the functions of VDUEX.

As I mentioned earlier, VDUEX should be used in graphics modes. This is due to its use of user-defined graphics, and the necessity for vertical continuity — not present in modes 3 or 6 — as VDUEX can generate double-height characters, so before anything type Mode 4. I should now perhaps tell you what VDUEX really does! Well, VDUEX gives function to the normally ignored code 27 so that it now assumes the form

VDU 27,F,C

where F is the function to be applied to character C. Functions available include double height, italicisation and continuous or dotted under-lining. All of these may be combined. F operates in a bit-dependent fashion so that each of the least significant four bits controls a function, as follows:

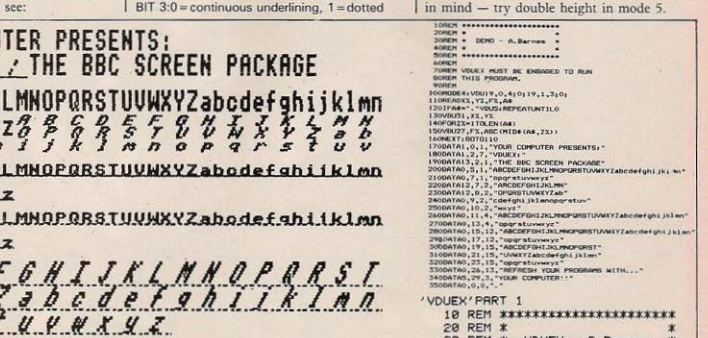
BIT 0:0 = normal height, 1 = double height.
BIT 1:0 = not italicised, 1 = italicised.
BIT 2:0 = no underline, 1 = underlined.
BIT 3:0 = continuous underlining, 1 = dotted underlining — both apply only if underlining is on.

For those who do not understand this the following explanation will hopefully make things clearer. Starting with F=0, add 1 to make C double height, 2 to make C italicised, 4 to make it underlined and 8 to make that underlining dotted. Remember that C is only the ASCII code of the character to be printed. Here are some examples to try out:

```
VDU27,1,ASC("!")
VDU27,6,67
VDU27,15,42
```

If any of the characters do not look right, but you are not sure, check against the screen dump of Demo. If you are sure they are misformed, reload part 2 — do not Run it — and check through, Saving the corrected version. Before you Run it again, do a hard reset and type Page=&1000 then Old. This is because during the first pass of assembly an incomplete machine-code program is stored and when Oswrch accessed VDUEX — if it was engaged — it would find a corrupt version and crash.

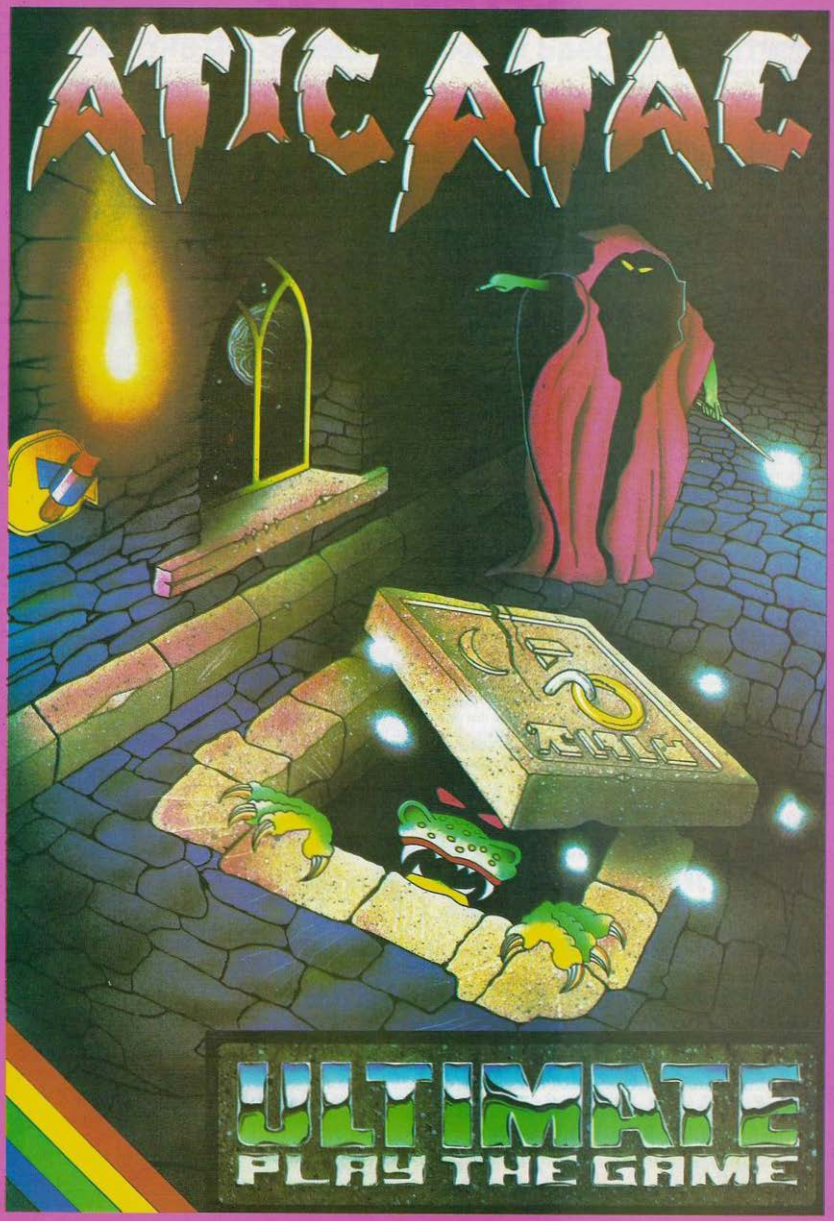
Now that you have a correct version of VDUEX on tape, ready to use with your own programs, we can try just that. Demo shows the new VDU code in action. VDUEX will probably be most useful to you in, for example, graph programs and educational applications. The program was in fact conceived with large characters for classrooms in mind — try double height in mode 5.

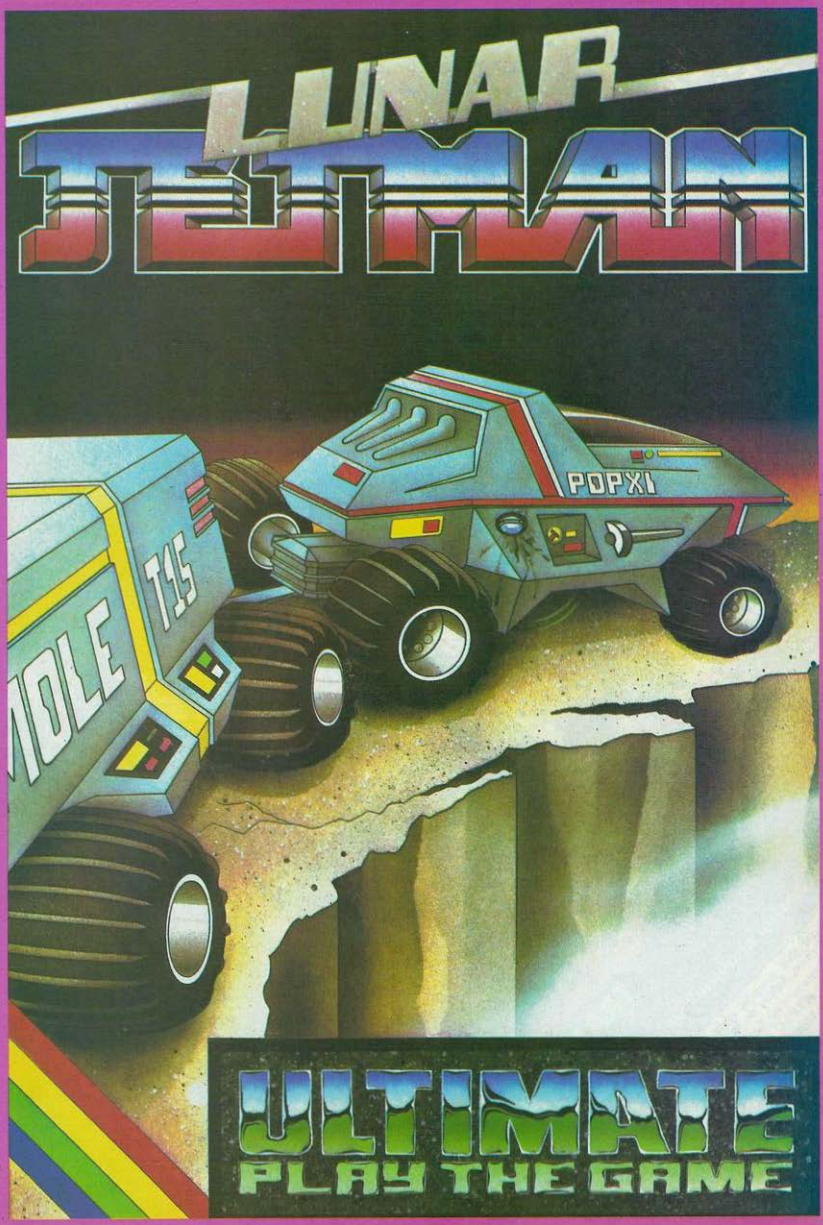



```
10REM ***********************
20REM *                     *
30REM *  DEMO - A.Barnes    *
40REM *                     *
50REM ***********************
60REM
70REM VDUEX MUST BE ENGAGED TO RUN
80REM THIS PROGRAM.
90REM
100MODE4:VDU19,0,4;0;19,1,3;0;
110READX$,Y$,F$,A$
120IFA$="."VDU5:REPEATUNTILO
130VDUX$,X$,Y$
140FOR%I=1TOLEN(A$)
150VDU27,F$,ASC(MID$(A$,%I))
160NEXT:GOTO110
170DATA1,0,1,"YOUR COMPUTER PRESENTS:"
180DATA1,2,7,"VDUEX:"
190DATA15,2,1,"THE BBC SCREEN PACKAGE"
200DATA0,5,1,"ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmn"
210DATA0,7,1,"opqrstuvwxyz"
220DATA12,7,2,"ABCDEFGHIJKLMN"
230DATA12,8,2,"OPQRSTUVWXYZab"
240DATA0,9,2,"cdefghijklmnopqrstuv"
250DATA0,10,2,"wxyz"
260DATA0,11,4,"ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmn"
270DATA0,13,4,"opqrstuvwxyz"
280DATA0,15,12,"ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmn"
290DATA0,17,12,"opqrstuvwxyz"
300DATA0,19,15,"ABCDEFGHIJKLMNOPQRST"
310DATA0,21,15,"UVWXYZabcdefghijklmn"
320DATA0,23,15,"opqrstuvwxyz"
330DATA0,26,13,"REFRESH YOUR PROGRAMS WITH..."
340DATA0,29,3,"YOUR COMPUTER!!"
350DATA0,0,0,"."
```

```
'VDUEX'PART 1
  10 REM ***********************
  20 REM *                     *
  30 REM *  VDUEX - A.Barnes   *
  40 REM *      PART 1         *
  50 REM *                     *
  60 REM ***********************
  70 PAGE=&1000:CHAIN""
```

(continued on page 203)


ATIC ATAC
ULTIMATE
PLAY THE GAME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Address .....

(continued from page 199)

```
 1OREM ***********************
 2OREM *                     *
 3OREM *  VDUEX - A.Barnes   *
 4OREM *      PART 2         *
 5OREM *                     *
 6OREM ***********************
 7OREM
 8OREM TYPE PAGE=&1000 BEFORE ENTERING
 9O REM FOR £ READ WASH CHARACTER
100char=&70:func=&7:ira=&72
110flag=&73:osvec=hi%20E ANDAMFFF
120bwaksvec=!&202 ANDAMFFF
130FORD%=0TO33STEP3
140P%=&D01:OPT OE
150.newosvech PHP:STAchar:PHA
160TXA:PHA:TYA:PHA
170LDAMflag:CMPE1:BEQ A
180CMPE2:BNE B
190LDAchar:STAfunc:LDAE3:STAflag:JMPrts
200.B CMPE3:BNE C
210JSRmainn:LDAE0:STAflag:JMPrts
220.C CLC:LDAchar:ADCE224:BCC D
230LDAchar:JSRowerch:JMPrts
240.D LDAchar:CMPE27:BNE E
250LDAE2:STAflag:JMPrts
260.E LDAchar:LDAendata,X
270BNE F:LDAchar:JSRowerch:JMPrts
280.F STAremel:LDAE1:STAflag
290LDAchar:JSRowerch:JMPrts
300.A LDAchar:JSRowerch
310BEQrewel:LDAewel:BNE rts
320LDAE0:STAflag
330.rts PLA:TAY:PLA:TAX
340PLA:PLP:RTS
350.main JSRpattern
360LDAfunc:ANDE1:BEQ A1
370LDAB0C03:STAB0C04:STAB0C07
380LDAB0C02:STAB0C04:STAB0C05
390LDAB0C01:STAB0C02:STAB0C03
400LDAB0C00:STAB0C01:STAB0C01
410.A1 LDAfunc:ANDE2:BEQ B1
420JSRtal
430LDAfunc:ANDE1:BEQ B1
440LDXE0
450.C1 LDAB0C00,X:STAB0C00,X
460LDAB0C01,X:STAB0C01,X
470LDAB0C02,X:STAB0C02,X
480LDAB0C03,X:STAB0C03,X
490INXCPXE8:BNE C1
500.B1 LDAfunc:ANDE1:BNE D1
510LDAfunc:ANDE4:BEQ D1
520JSRbul
530.D1 LDAE224:JSRowerch
540LDAfunc:ANDE3:BEQ E1
550LDAZ25:JSRowerch
560.E1 LDAfunc:ANDE1:BNE F1:RTS
570.F1 JSRpattern
580LDAB0C04:STAB0C00:STAB0C01
590LDAB0C05:STAB0C02:STAB0C03
600LDAB0C06:STAB0C04:STAB0C05
610LDAB0C07:STAB0C06:STAB0C07
620LDAB0C08:STAB0C07
630JSRtal
640.B1 LDAfunc:ANDE4:BEQ H1
650JSRbul
660.H1 LDAE10:JSRowerch
670LDAE8:JSRowerch
680LDAfunc:ANDE2:BEQ I1
690LDAE8:JSRowerch
700.I1 LDAZ224:JSRowerch
710LDAfunc:ANDE2:BEQ J1
720LDAZ25:JSRowerch
730.J1 LDAE11:JSRowerch
740RTS
750.pattern LDAABFF:PHA
760LDAchar:STAABFF
770LDAE1:LDXZ25:LDYE5b:JSRAFFF1
780PLA:STAABFF:RTS
790.tal LDAE5:TAX
800.A2 STAB0C08,X:INX:CPXE8:BNE A2
810LDRAC00:RORAC00:LSRAC00:RORAC08
820LSRAC00:RORAC00:LSRAC01:RORAC09
830LSRAC01:RORAC09:LSRAC01:RORAC09
840LSRAC02:RORAC0A:LSRAC02:RORAC0A
850LSRAC03:RORAC0B:LSRAC03:RORAC0B
860LSRAC04:RORAC0C:LSRAC05:RORAC0C
870RTS
880.ul LDAfunc:ANDE8:BNE A3
890LDAZ25:STAB0C0:STAB0C0F:RTS
900.A3 LDAZ205:STAB0C0:STAB0C0F:RTS
910.breakhandle LDAE0:STAflag
920JMPbreakwec
930.lendata:INEXT
940FORAS=0TO31:READ"T%:P%=T%:INEXT
950:REY10 PAGE=&1000:!&E00=&BDOC04:!&202=!&202 ANDAF
FFF0000 OR(B1:!&206=&20E ANDAFFF0000 OR(B3)P(M):JBB
C Computer(_(@(CVDUEX - A.Barnes(_(@(EBASIC(_(@(G)(JU
(_(A(B
960PRINT"PRESS ANY KEY TO ENGAGE VDUEX":Z%=GET
970CLS:MFFFC
980DATAO,1,0,0,0,0,0,0
990DATAO,0,0,0,0,0,0,0
1000DATAO,1,2,5,0,0,1,9
1010DATAB,5,0,0,4,4,0,2
```

Self-writing

Jeremy H Lee,
Northleach,
Gloucestershire.

VIC-20

MACHINE-CODE PROGRAMS written with the monitor cartridge take a long time to transfer into Data statements for use within a Basic program if you want the flexibility of having the code as part of your Basic. Also, character bit maps created using programs that let you make the character without bothering with bit patterns and hexadecimal-decimal conversion still may be required to turn into Data statements.

Here is a program that will take memory locations within a specified range, print out a compact Data statement with a specified line number and actually enter it to itself without user-intervention. It makes use of the fact that if any numbers are left in the keyboard buffer, or put there deliberately and the keyboard buffer pointer is not zero, then those numbers will be taken as valid ASCII, including carriage return. Location 198 is the keyboard buffer pointer, location 632 is the first location in the keyboard buffer, 640 is the last.

When the program is Run, it will ask for a start line number. This requires that you enter the value of the line number that you would like the program to start entering lines. Since the line number is kept in location 0, you may only have lines from 0 to 255. This should not be much of a limitation unless you already have a program there. If this is the case, however, it is simple to add an offset by changing line 60010 to:

```
60010 K = PEEK(0) + I . . . etc.
```

where I is an offset, for example, I = 600 and you chose line start as 7, then the Data statements will start at 607 and go in increments of one. If you do not want them to go in increments of one, then change line 60010 to:

```
60010 K = PEEK(0)*S . . . etc.
```

where S is a scaling factor, thus, if S = 10 then the line numbers will go in increments of 10. Obviously the two can be combined, giving an offset as well as an increment:

```
60010 K = PEEK(0)*S + I . . . etc.
```

The listing of the program, written for a Vic-20, should pose no problems to other micro users if their computers have a similar type of keyboard buffer system and know the respective locations. The cursor control keys are in brackets in the listing to ease interpretation. For example (home) means home the cursor; (clr) means clear screen; (down 3) means move the cursor down three times.

There is just one other point about using the program. When an end location is specified and it is not a factor of 10 away from the start location, the data contained in the last location, plus the consecutive locations up to 10, will be contained in the last line entered. This is no problem except that it may use a few extra bytes of memory. In any case it is not much work to delete the unwanted values.

```
 0 REM AUTO DATA PROGRAM BY J.H.LEE FOR VIC 20
59900 PRINT"(CLR)ENTER START LINE NO.";PRINT"(DOWN)(0-255)(DOWN)
59901 INPUT$;K=VAL(K$):POKE0,K
59902 INPUT"(CLR)ENTER START LOCATION";D$:D=VAL(D$)
59903 PRINT"(CLR)ENTER END LOCATION";INPUTE$:E=VAL(E$)
60000 IFPEEK(0)=255THENPRINT"(CLR)(DOWN8)(RIGHT1)OUT OF LINE NOS.";END
60001 IFD>ETHENPRINT"(CLR)(DOWN5)(RIGHT5)FINISHED";END
60002 PRINT"CLR)(DOWN6:D="D+12":E="E":GOTO60000:HOME:(DOWN2)
60010 K=PEEK(0):F$=STR$(K)+"DATA"+STR$(PEEK(D))
60100 PRINTF$;
60200 FORD=D+1TOD+10
60300 K$=","+MID$(STR$(PEEK(D)),2,3)
60400 PRINTF$;
60500 NEXT:POKE0,PEEK(0)+1
60510 PRINT"(HOME)"
60520 POKE631,13:POKE632,13:POKE633,13:POKE198,3
```

Mean machine

Gareth N Woodhead,
Bradford,
West Yorkshire.

SPECTRUM

YOUR TASK IS TO manoeuver your Mean Machine around the race circuit — avoiding the walls. If your car accidently drives over an oil-slick, then you may slide and therefore lose one car.

After using your three cars, press key Y or key N to run or stop the game. The games uses normal cursor keys.

Graphic notes.

11 Graphic H.
101 Graphic A, Graphic C, Graphic J and Graphic I.
131 Graphic F.
132 Graphic E.
133 Graphic H.
134 Graphic G.
150 Graphic Shifted 8.

```
   1 GO TO 7500
   2 GO SUB 9000
   3 LET d=0
   4 LET g?h=INT (RND*7)
   5 LET gs1=0
  10 LET y=32 LET y=14  LET live
s=3  LET lap$=0
  11 LET z$=" " LET b$="5
  98 POKE 23692,255
 100 PRINT AT 21,0  FOR n=1 TO
22  INK g?n  PRINT a$(n) NEXT n
 101 INK 9  PRINT AT 9,22;"AC A
T";10,22;"JI";AT 16,4;"AC";AT 17
4;"JI"
 108 PRINT AT 20,7  INVERSE 1;
LIVES=  LAP$=  " INVERSE 0
 109 INK g?h
 110 IF INKEY$()"" THEN LET b$=I
NKEY$
 111 INVERSE 1  INK 9  PRINT AT
20,14;LIVES  PRINT AT 20,22;LAP$
 INVERSE 0 INK 0
 112 IF LIVES=0 THEN GO TO 7000
 113 BEEP .01,-25
 114 BEEP .01,-15
 131 IF b$="6" THEN LET z$= F"
LET x=x+1  PRINT AT x-1,y;
 132 IF b$=" " THEN LET z$= E"
LET x=x-1  PRINT AT x+1,y;
 133 IF b$="8" THEN LET z$= H
LET y=y+1  PRINT AT x,y-1;
 134 IF b$="5" THEN LET z$= G
LET y=y-1  PRINT AT x,y+1;
 135 IF y=17 AND x>16 AND d=0 TH
EN LET d=1
 137 IF y=18 AND x<3 AND d=1 THE
N LET lap$=lap$+1  LET d=0
 140 PRINT AT x,y; INK 1;z$
 145 IF lap$=20 AND gs1=0 THEN L
ET gs1=1
 149 IF gs1=1 THEN GO TO 400
 150 IF a$(x+1,y+1)="■" THEN GO
TO 8000
 161 IF (x=9 OR x=10) AND (y=22
OR y=23) THEN GO TO 1000
 162 IF (x=16 OR x=17) AND (y=4
OR y=5) THEN GO TO 1000
 170 GO TO 110
 400 LET lives=lives+1  FOR f=1
TO 30  FOR g=1 TO 30 STEP 7  BEE
P .01,9  NEXT g  NEXT f  LET gs1
=2
 401 GO TO 150
1000 FOR m=1 TO 3
1001 PRINT AT x,y;
1002 LET x=x+INT (RND+2)
1003 LET y=y+INT (RND+2)
1004 PRINT AT x,y; INK 2;z$
1005 IF a$(x+1,y+1)="■" THEN GO
TO 8000
1006 FOR g=1 TO 10  NEXT g  NEXT
m
1007 PRINT AT 9,22  AC  AT 10,22
"JI" AT 15,4  AC" AT 17 4  JI"
1010 GO TO 110
7000 PRINT AT 11,10; INK 9  "NOT
HER GO!"
7009 IF INKEY$=n" THEN STOP
7010 IF INKEY$=y" THEN GO TO 3
7020 GO TO 7010
7500 INK 1  CLS  PLOT 100 180
DRAW 16,0  DRAW 0,-12  DRAW -4,-
4  DRAW 4,0  DRAW 0,-8  DRAW -8,
8  DRAW 0,-8  DRAW -8,0  DRAW 0,
24
```

(continued on page 205)

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(continued from page 203)

```
7501 PLOT 107,152: DRAW 4,0: DRAW 0,-4: DRAW -4,0: DRAW 0,4
7502 PLOT 122,152: DRAW 16,0: DRAW 0,-16: DRAW -6,0: DRAW 0,4: DRAW -4,0: DRAW 0,-4: DRAW -6,0: DRAW 0,16: PLOT 128,148: DRAW 4,0: DRAW 0,-4: DRAW -4,0: DRAW 0,4
7503 PLOT 144,152: DRAW 16,0: DRAW 0,-4: DRAW -12,0: DRAW 0,-8: DRAW 12,0: DRAW 0,-4: DRAW -16,0: DRAW 0,16
7504 PLOT 166,152: DRAW 16,0: DRAW 0,-4: DRAW -12,0: DRAW 0,-2: DRAW 8,0: DRAW 0,-4: DRAW -8,0: DRAW 0,-2: DRAW 12,0: DRAW 0,-4: DRAW -16,0: DRAW 0,16
7505 PLOT 186,140: DRAW 4,0: DRAW 0,-4: DRAW -4,0: DRAW 0,4
7506 PLOT 100,134: DRAW 90,0: PLOT 100,132: DRAW 90,0
7510 PRINT AT 6,0,"                By G.N.Woodhead."
7520 PRINT : PRINT " The object of this game is to drive your blue car round the  race track."
7530 PRINT : PRINT " Beware of the Oil slicks!!"
7540 PRINT : PRINT " You start off with 3 cars, but each time you crash into a wall you lose 1 car..."
7550 PRINT : PRINT " If you manage to survive 20    laps you will receive 1 extra         car... - GOOD-LUCK!!"
7560 PRINT "   5 RIGHT 6 DOWN 7 UP 8 LEFT"
7561 PRINT #1,"             PRESS ANY KEY."
7570 PAUSE 0
7575 CLS
7580 RUN 2
8000 FOR z=1 TO 6: BEEP .1,-10: PRINT AT x,y; INVERSE 1; INK 2;"*": FOR a=1 TO 21: NEXT a: PRINT AT x,y;z$: NEXT z: BEEP 1,-20: INK 9: PRINT AT x,y;"[graphics]": LET lives=lives-1: LET x=2: LET y=15: LET z$="G": INK 9: LET d=0: LET b$="0"
8005 PRINT AT 9,22;"AC";AT 10,22;"JI";AT 16,4;"AC";AT 17,4;"JI"
8010 GO TO 110
9000 FOR b=1 TO 10: READ b$: FOR n=0 TO 7: READ a: POKE USR b$+n,a: NEXT n: NEXT b
9001 DATA "a",15,31,31,63,127,241,245,245
9002 DATA "b",0,0,0,255,0,0,0,0
9003 DATA "c",240,248,248,252,254,94,95,95
9004 DATA "d",8,4,2,255,2,4,8,0
9005 DATA "e",60,219,255,219,24,219,255,219
9006 DATA "f",219,255,219,24,219,255,219,60
9007 DATA "g",119,119,162,255,255,162,119,119
9008 DATA "h",238,238,69,255,255,69,238,238
9009 DATA "i",95,67,254,254,252,248,248,240
9010 DATA "j",245,241,127,127,63,31,31,15
9019 DIM a$(22,32)
9020 LET a$(1)="[graphics]"
9030 LET a$(2)="[graphics]"
9040 LET a$(3)="[graphics]"
9050 LET a$(4)="[graphics]"
9060 LET a$(5)="[graphics]"
9070 LET a$(6)="[graphics]"
9080 LET a$(7)="[graphics]"
9090 LET a$(8)="[graphics]"
9100 LET a$(9)="[graphics]"
9110 LET a$(10)="[graphics]"
9120 LET a$(11)="[graphics]"
9130 LET a$(12)="[graphics]"
9140 LET a$(13)="[graphics]"
9150 LET a$(14)="[graphics]"
9160 LET a$(15)="[graphics]"
9170 LET a$(16)="[graphics]"
9180 LET a$(17)="[graphics]"
9190 LET a$(18)="[graphics]"
9200 LET a$(19)="[graphics]"
9210 LET a$(20)="[graphics]"
9220 LET a$(21)="[graphics]"
9221 LET a$(22)="[graphics]"
9230 RETURN
```

Fireball

M C Ironmonger,
Brighouse,
West Yorkshire.

DRAGON

FIREBALL IS A GAME written for the Dragon 32. It runs in high-resolution mode 4 and is therefore in black and white only.

The game is set in six seven-layered buildings, each layer connected by ladders. Each building is occupied by intelligent fireballs which are intent on burning you to a cinder. Your job is simply to extinguish every fireball in every building — 21 fireballs in all. Building one has one fireball, building two has two, and so on up to building six. Each building also has a time limit in which to be cleared.

You move around the buildings using the four direction keys. The 14 rocks in each building are your only means of killing a fireball. To pick up a rock stand below it and press the spacebar, which, when pressed again, drops the rock to the right of you. If a rock is dropped on to a girder it smashes a hole in it, into which you must coax a fireball. Once it falls in kill it by dropping another rock onto it. But beware, if the fireball is not killed, it will eventually jump out of the hole.

After a killing if there are any remaining fireballs one will continue the chase, starting at the top right of the current building. Meanwhile the dead fireballs are still very hot and will burn your feet if you try and walk over them.

As the game progresses the speed increases and the ladders get shorter making the game more difficult.

You earn 100 points for every fireball you kill and the time left after the completion of each building is added to the score.

The rules may seem complicated at first but the game is simple and requires a good deal of thought and skill especially in the later buildings.

```
10 REM ************************
20 REM **     FIREBALL       **
30 REM **     (C) 1983       **
40 REM **  M.C.IRONMONGER    **
50 REM ************************
60 GOTO570
70 FORF=248TO40STEP-1:LINE(F,9)-(F,7),PRESET:FORG=1TO3:FORY=1TOL*40:NEXT
80 E=PEEK(135):IFE=9THEN140ELSEIFE=8THEN150ELSEIFE=94THEN160ELSEIFE=10THEN170ELSEIFE=32THEN320ELSEFORY=1TO50:NEXT
90 IFA=C ANDB=D THEN120ELSEGOSUB180:IFA=C ANDB=D THEN120ELSENEXTG,F:GOTO110
100 IFPPOINT(A,B+2)=5THEN90
110 LINE(A,B-6)-(A+7,B-7),PRESET,BF:B=B+2:PUT(A,B)-(A+7,B-7),A,PSET:IFPPOINT(A,B+2)=5THEN120ELSE110
120 FORC=1TO10STEP2:PLAY"T25A":CIRCLE(A+3,B-3),C:NEXTC:FORC=10TO1STEP-3:PLAY"C":CIRCLE(A+3,B-3),C,0:NEXT
130 GOTO740
140 PUT(A,B)-(A+7,B-7),B,PSET:A=A+8:GET(A,B)-(A+7,B-7),B,G:PUT(A,B)-(A+7,B-7),A,PSET:GOTO100
150 PUT(A,B)-(A+7,B-7),B,PSET:A=A-8:GET(A,B)-(A+7,B-7),B,G:PUT(A,B)-(A+7,B-7),A,PSET:GOTO100
160 IFPPOINT(A+7,B-8)=0THEN100ELSEPUT(A,B)-(A+7,B-7),B,PSET:B=B-8:GET(A,B)-(A+7,B-7),B,G:PUT(A,B)-(A+7,B-7),A,PSET:GOTO100
170 IFPPOINT(A,B+1)=0THEN90ELSEPUT(A,B)-(A+7,B-7),B,PSET:B=B+8:GET(A,B)-(A+7,B-7),B,G:PUT(A,B)-(A+7,B-7),A,PSET:GOTO100
180 ON H GOSUB200,240,250,300,370
190 IFPPOINT(C+3,D+2)=5ORH=5THENRETURNELSEH=5:GOTO360
200 X=8:Y=0:IFC<240THEN210ELSEH=2:GOTO240
210 IFB<D THEN220ELSEIFB>D THEN230ELSE310
220 IFPPOINT(C,D-8)=0THEN310ELSEH=4:X=0:Y=-8:GOTO310
230 IFPPOINT(C,D+1)=0THEN310ELSEH=3:X=0:Y=8:GOTO310
240 X=-8:Y=0:IFC>8THEN210ELSEH=1:GOTO200
250 X=0:Y=8
260 IFA<C THEN280ELSEIFA>C THEN290
270 IFPPOINT(C,D+Y)=5THEN310ELSEONRND(2)GOTO280,290
280 IFPPOINT(C-1,D+2)=0THEN270ELSEH=2:X=-8:Y=0:GOTO310
290 IFPPOINT(C+8,D+2)=0THEN270ELSEH=1:X=8:Y=0:GOTO310
300 X=0:Y=-8:GOTO260
310 PUT(C,D)-(C+7,D-7),E,PSET:C=C+X:D=D+Y:GET(C,D)-(C+7,D-7),E,G:PUT(C,D)-(C+7,D-7),F,PSET:RETURN
320 IFI=1THEN340ELSEIFPPOINT(A+1,B-11)=0THEN90
330 I=1:POKE135,0:LINE(A,B-8)-(A+7,B-15),PRESET,BF:PLAY"T3001C":GOTO90
340 I=0:LINE(A+8,B+1)-(A+15,B+8),PRESET,BF:IFA+8=C ANDB+8=D THEN350ELSEPLAY"T3001D":GOTO90
350 PUT(C,D)-(C+7,D-7),F,PSET:PLAY"T3001GFEDT3C":M=M-1:S=S+100:IFM>0THEN390ELSE540
360 PUT(C,D)-(C+7,D-7),E,PSET:D=D+8:PUT(C,D)-(C+7,D-7),F,PSET:X=RND(50)+L*10:RETURN
370 PLAY"T7003C":X=X-1:IFX>0THEN380ELSED=D-8:PUT(C,D)-(C+7,D-7),F,PRESET:H=RND(2):ON H GOTO200,240
380 PUT(C,D)-(C+7,D-7),E,PSET:FORE=1TO100:NEXT:PUT(C,D)-(C+7,D-7),F,PSET:RETURN
390 LINE(100+M*10,20)-(107+10*M,13),PRESET,BF:C=192:D=39:H=2:GOTO90
400 I=0:L=L-1:M=7-L:PCLS
410 DRAW"BM10,11U6L2R5L2D6BR4R2U6L2R5L2D6R2BR2U6R1D6U5R1D1F1U1R1U1R1U1D6R1U6BR2R6L6D6R6L5U6D3R3
420 FORA=191TO47STEP-24:DRAW"BM8,"+STR$(A)
430 FORB=1TO20:DRAWA$:NEXTB,A
440 RESTORE:FORA=1TO9:READB,C:D=RND(L)*3
450 IFC-8*D<40THEND=D-3:GOTO450ELSELINE(B,C-1)-(B+7,C-8*D-8),PRESET,BF
460 FORE=0TOD:DRAWB$:NEXTE,A
470 DATA 232,184,16,184,96,160,72,136,200,112,176,136,48,88,120,64,144,88
480 FORA=32TO216STEP184:FORB=55TO175STEP24:PUT(A,B)-(A+7,B-7),C,PSET:NEXTB,A
490 LINE(40,9)-(247,7),PSET,BF
500 GET(0,100)-(7,93),B,G
510 GET(0,100)-(7,93),E,G
520 FORX=100TO100+(6-L)*10STEP10:PUT(X,20)-(X+7,13),F,PSET:NEXT
530 A=96:B=183:H=2:C=216:D=39:GOTO710
540 S=S+F:CLS8:IFL=1THEN840ELSEPRINT@108,"WELL DONE";:PRINT@167,"BUILDING ";7-L;"CLEARED";
550 PRINT@387," GET READY FOR BUILDING";8-L;
560 GOTO400
570 S$="THE DRAGON 32":DIMA(0,8),B(0,8),C(0,6),E(0,8),F(0,8):PMODE4,1:PCLS
580 DRAW"BM101,99R5E1L7U1R7U1L7U1R7H1L5":GET(100,99)-(107,94),C,G
590 A$="BR1R0BR2R0BR2R0BR2R0BR2R0BR2R0U1L11U1E1R1E1R1E1R1F1R1F1R1F1BU4L11R1U1BR2R0BR2R0BR2R0BR2R0BR2R0BM+1,+7"
600 B$="D7U2L7D2U7D1R7BD7
610 DRAW"BM96,183R1U1R1U1R3D1R1D1R1BU3H1L5G1BR3R1U2L1H1R3H1L1
620 GET(96,183)-(103,176),A,G
630 DRAW"BM193,39R5E1L7U1R7U1L7E1H1F1R5E1G1H1E1G1L3H1F1E1H1F1R1E1G1
640 GET(192,39)-(199,32),F,G
650 L=7:POKE&HFFD7,0:CLS:PRINT@12,"fireball"
660 PRINT:PRINT" YOU CONTROL THE MAN,WHO MUST    KILL THE FIREBALLS IN EACH OF   THE SIX BUILDINGS.
670 PRINT" TO GRAB A ROCK,OR DROP ONE        PRESS THE SPACE BAR.
680 PRINT" WHEN A FIREBALL DROPS IN A      HOLE YOU CAN DESTROY IT BY       DROPPING A ROCK ON IT.
690 PRINT" BUILDING 1 HAS 1 FIREBALL,      BUILDING 2 HAS 2 AND SO ON FOR  SIX BUILDINGS
700 PRINT" USE THE CURSOR KEYS TO MOVE     YOUR MAN AROUND THE SCREEN.":PRINT@490,"PLEASE WAIT";:GOTO400
710 I$=INKEY$:PRINT@489,"PRESS ANY KEY";:PLAY"T4O2CC"
720 PUT(A,B)-(A+7,B-7),A,PSET
730 IFINKEY$=""THEN730ELSESCREEN1,1:GOTO70
740 CLS8:PRINT@38,"HARD LUCK YOU'RE DEAD";
750 PRINT@166,"YOUR FINAL SCORE WAS:";
760 PRINT@237,"";:PRINTUSING"££££££";S;
770 IFS>HS THEN820
780 S=0:PRINT@385,"HISCORE";HS;"BY ";S$;
790 PRINT@481,"DO YOU WANT ANOTHER GAME (Y/N)";:Z$=INKEY$
800 Z$=INKEY$:IFZ$="N"THEN810ELSEIFZ$="Y"THEN650ELSE800
810 POKE&HFFD6,0:CLS:END
820 HS=S:PRINT@289,"THATS A NEW HISCORE,ENTER YOUR";:PRINT@321,"NAME PLEASE ";STRING$(100,255);:PRINT@333,"";:INPUTS$
830 IFLEN(S$)>14THEN820ELSEPRINT@351,CHR$(255);:GOTO700
840 CLS8:PRINT@36,"WELL DONE YOU VE FINISHED";:S=S+1000:GOTO750
```

Double-height

Martin Donaghy,
Dungannon,
County Tyrone.

VIC-20

HERE IS A short but useful routine to print double-height characters on unexpanded Vic-20. Not many Vic owners realise that the machine has this capability.

The drawback to the routine is that it only leaves around 900 bytes free, since it reserves almost 2.5K to make a copy of the character generator from ROM to RAM.

```
5 REM*********************
6 REM DOUBLE HEIGHT (BASIC)
7 REM*********************
8 POKE 657,128
10 REM LOWER TOP OF MEMORY
20 REM TO PROTECT CHARACTERS.
30 POKE 56,20:POKE 55,0
40 BEGIN=5120:FINISH=7678
50 REM READ CHRACTERS FROM
60 REM ROM TO RAM.
70 FORI=BEGIN TO FINISH STEP 2
80 P=PEEK(32768+(I-BEGIN)/2)
90 REM PUT  DATA INTO RAM
100 POKEI,P:POKEI+1,P
110 NEXTI
120 REM TELL VIC WHERE CHRACTERS ARE
130 POKE 36869,253
140 REM CLEAR SCREEN & CHANGE IT
150 PRINTCHR$(147):POKE36867,29:POKE36865,29
160 REM SAMPLE PRINT
170 PRINTTAB(44);"DOUBLE HEIGHT ON VIC"
180 END
```

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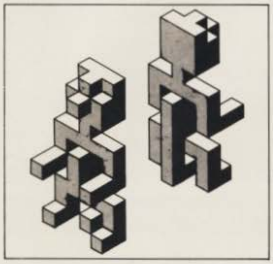
COMPETITION CORNER

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in October. The name of the winner, the solution, and a competition report will be published in the December, 1983 issue of *Your Computer*.

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

COMPETITION RESULTS

AUGUST'S COMPETITION for a Comx 35 asked readers to complete the sentence "A Comx 35 would make my summer holiday come alive because . . .". It seems that some computer buffs suffer in the sun and would rather trade the joys of sea and sand for the pleasure of the keyboard. "Peeking and poking are more fun than sun soaking" was the way P Winthrop put it; a point which was echoed by S Randles' "I could byte back at the bugs and boredom".

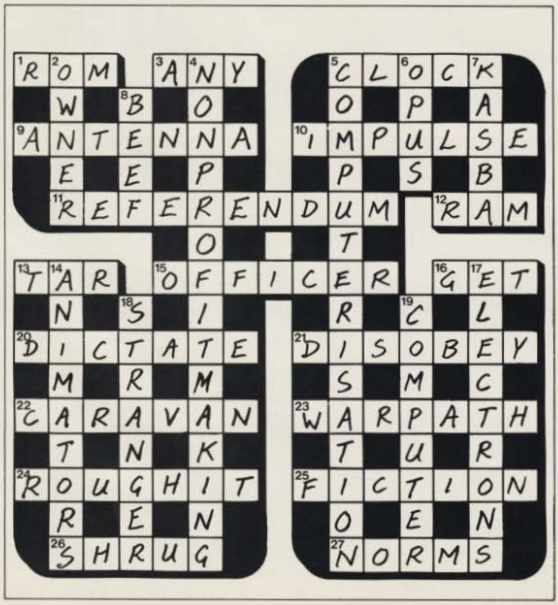


On the same theme were J Eagle's "A daily fix of Comx trix will last longer than holiday pix" and from N Mayes "its an end to those lazy, hazy, bored-crazy days of summer".

After all this holiday gloom the winning entry A Caslaw, 31 Purton Stocke, Swindon, Wiltshire came as a relief. Punning away shamelessly he wrote "A Comx is dandy and I'll have a beano with it".

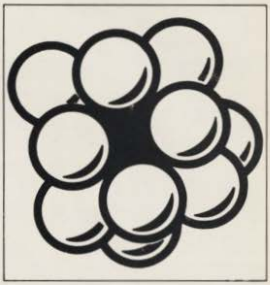
Competitors who cracked the intergalactic code in the Strange Encounter problem found that the alien beings were equipped with five limbs, two arms and three legs — or as one entry argued two legs and a prehensile tail. An artist's impression of the alien is shown here.

The £15 book token goes to the first correct solution picked at random which came from J Frost, 31 Oakham Grove, Ashby de la Zouche, Leicestershire.

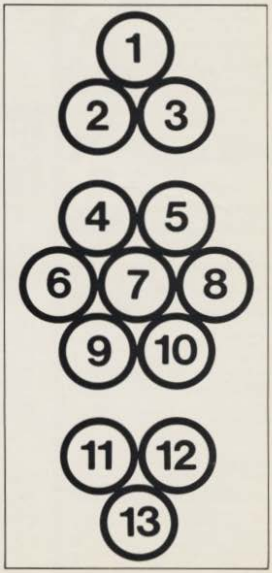


WOODWORM

BY ANTHONY ROBERTS



WILLY THE WOODWORM is having a lovely life chewing his way through the symmetrical cluster of wooden balls shown here. What he especially loves is variety and, luckily, each ball is made out of steadily more dense wood — one is balsa, 13 is ebony, in our diagram. Willy will chew his way through eight of the balls before reaching maturity and flying off. If you total the difference between the densities of each consecutive ball on his routine, you will see that he enjoyed the maximum possible variety — what is that total? Of course, there is no way to return to a ball after it has been visited once — it has all been chewed away!



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RAM memory supplied: 16 KBytes (Expandable to 48 KB)
Keyboard: 48 key QWERTY with control and function keys (user definable), full upper and lower case capability, alpha lock, auto repeat
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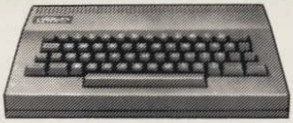

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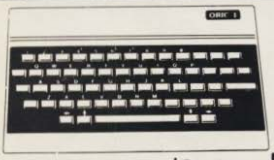

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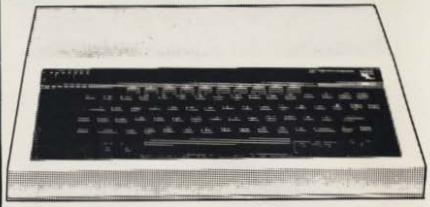

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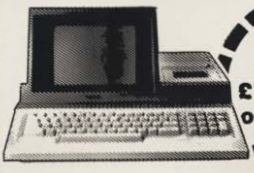

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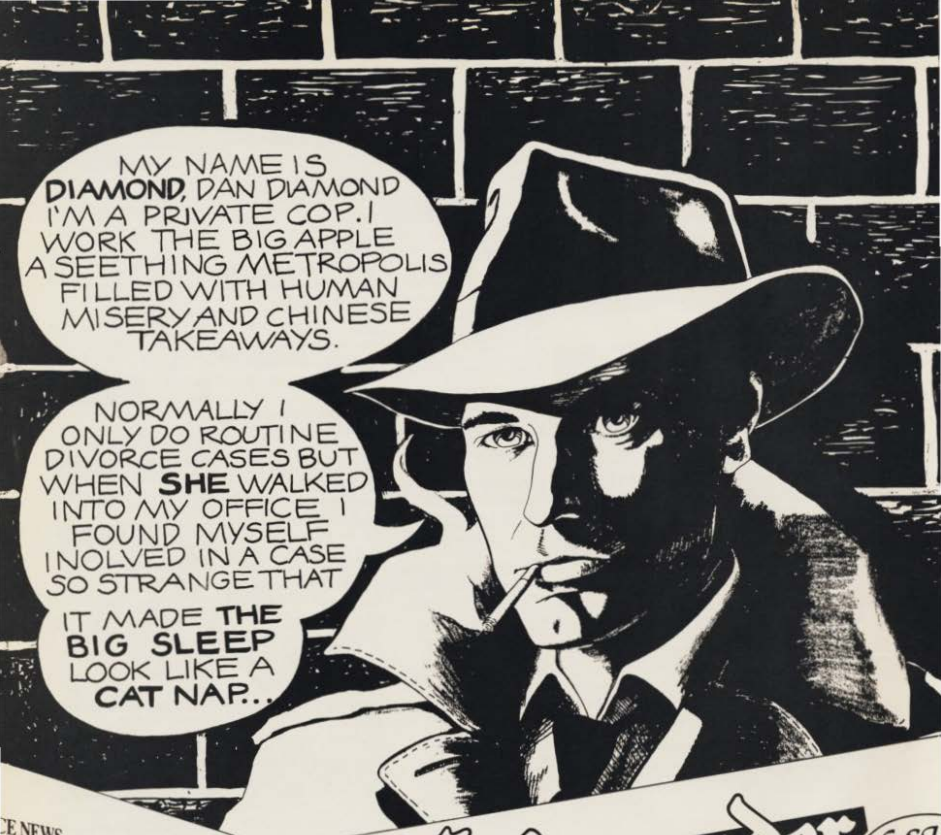

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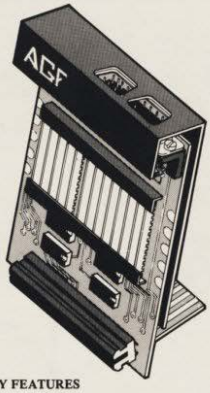

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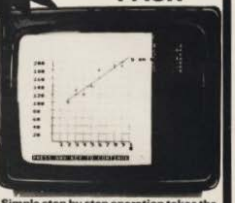

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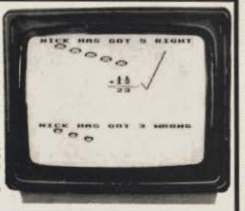

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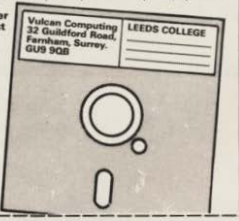

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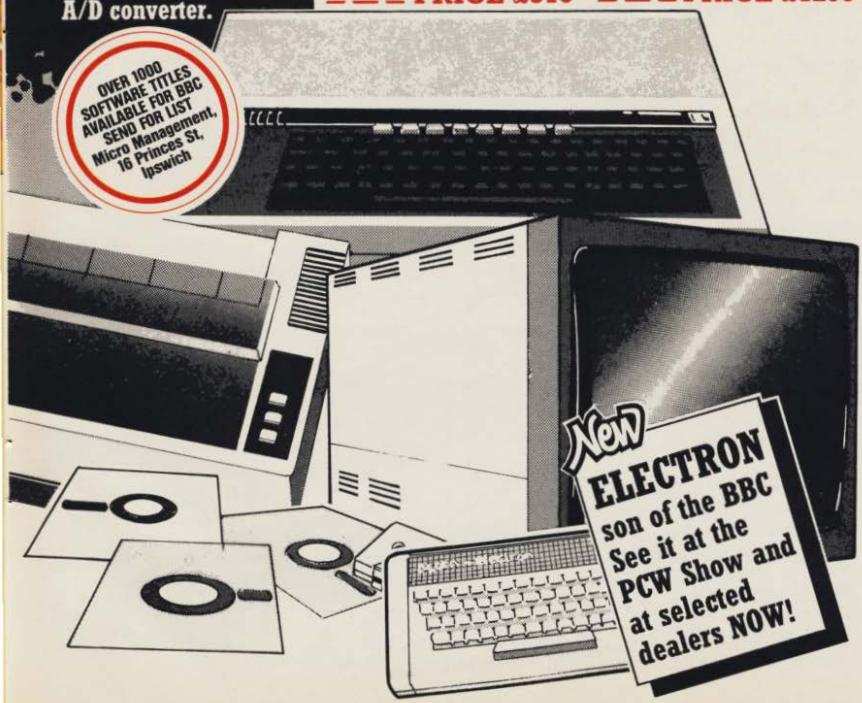

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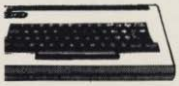

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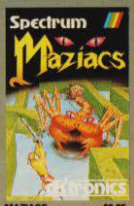

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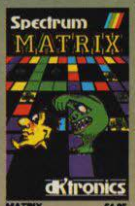

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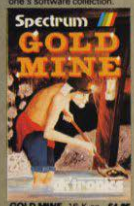

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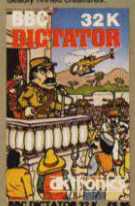

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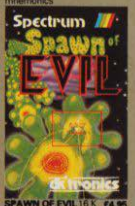

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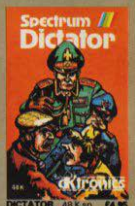

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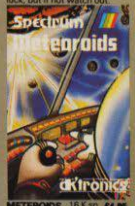

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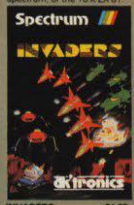

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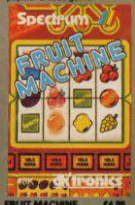

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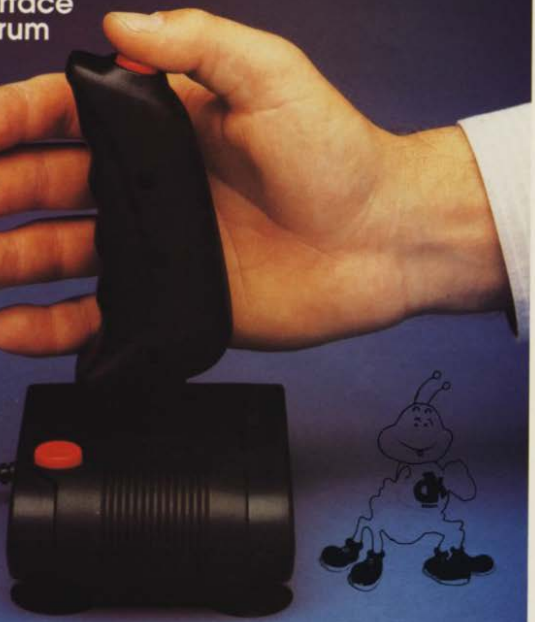

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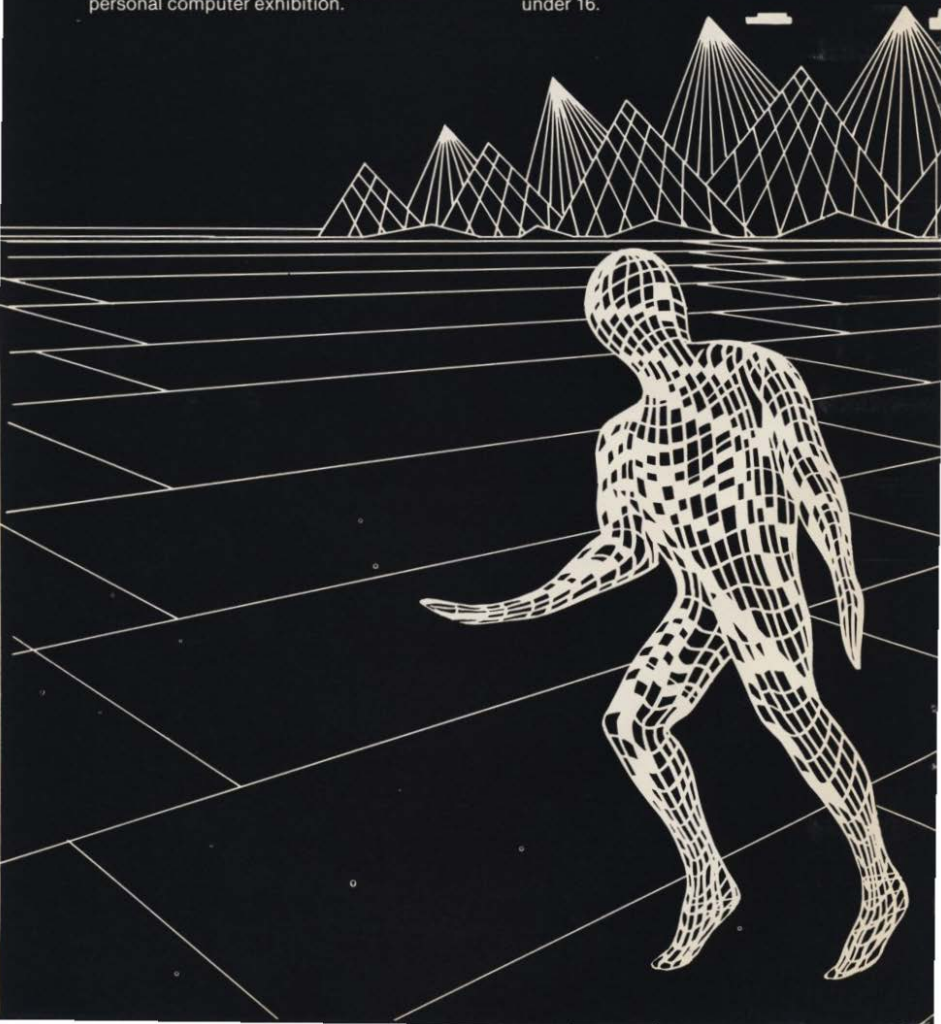

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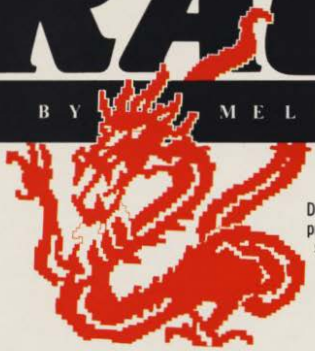

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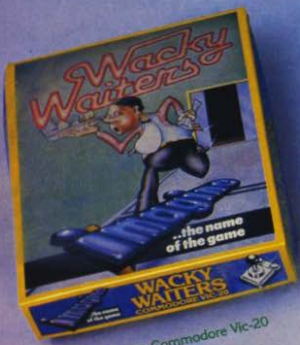

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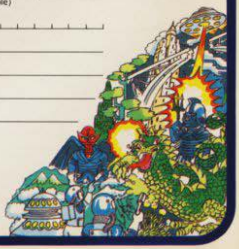

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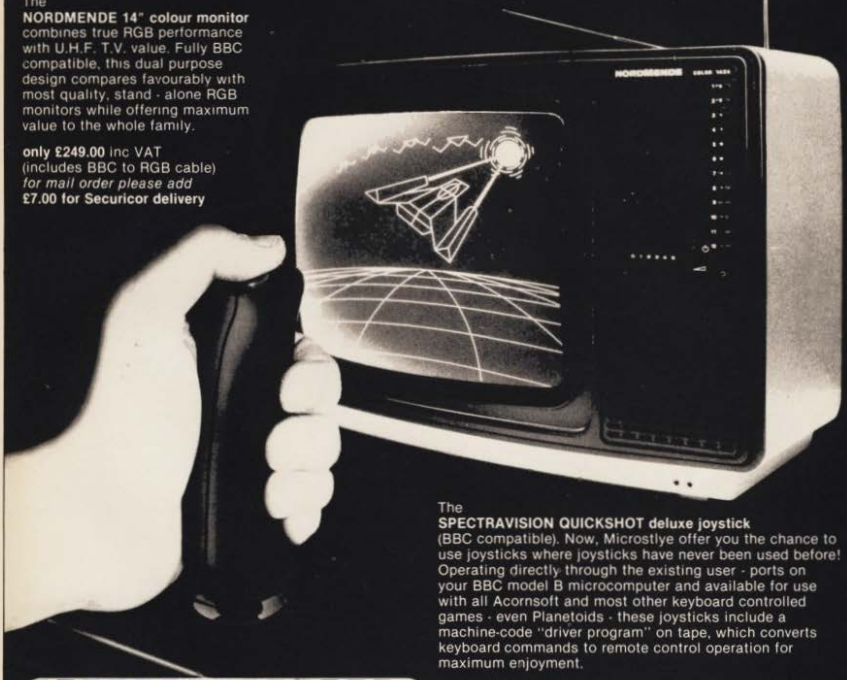

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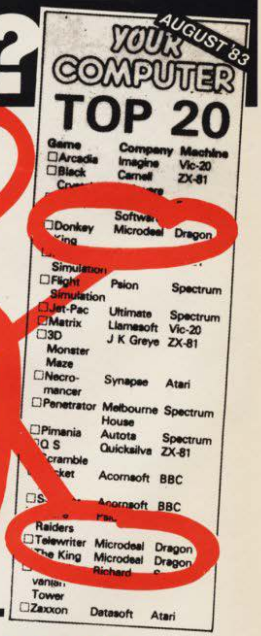

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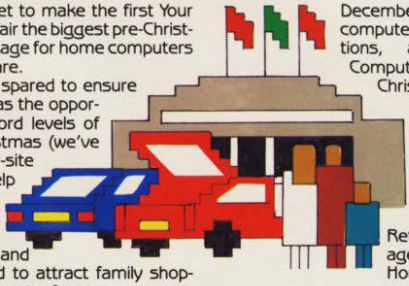

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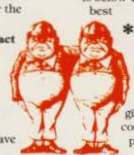

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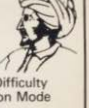

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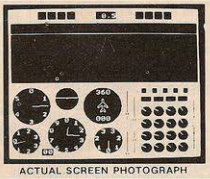

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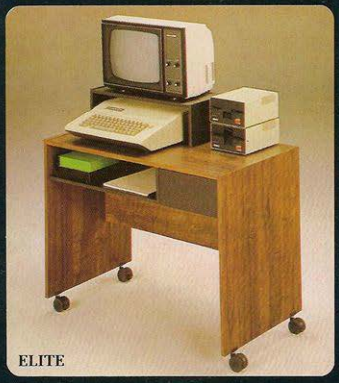

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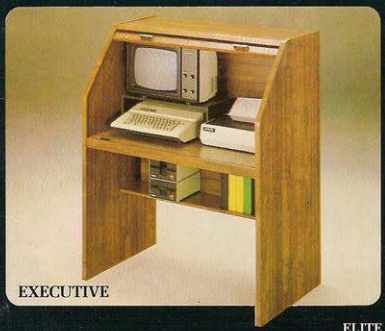

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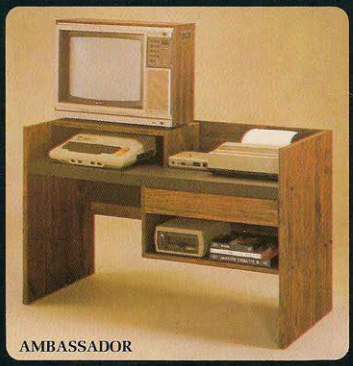

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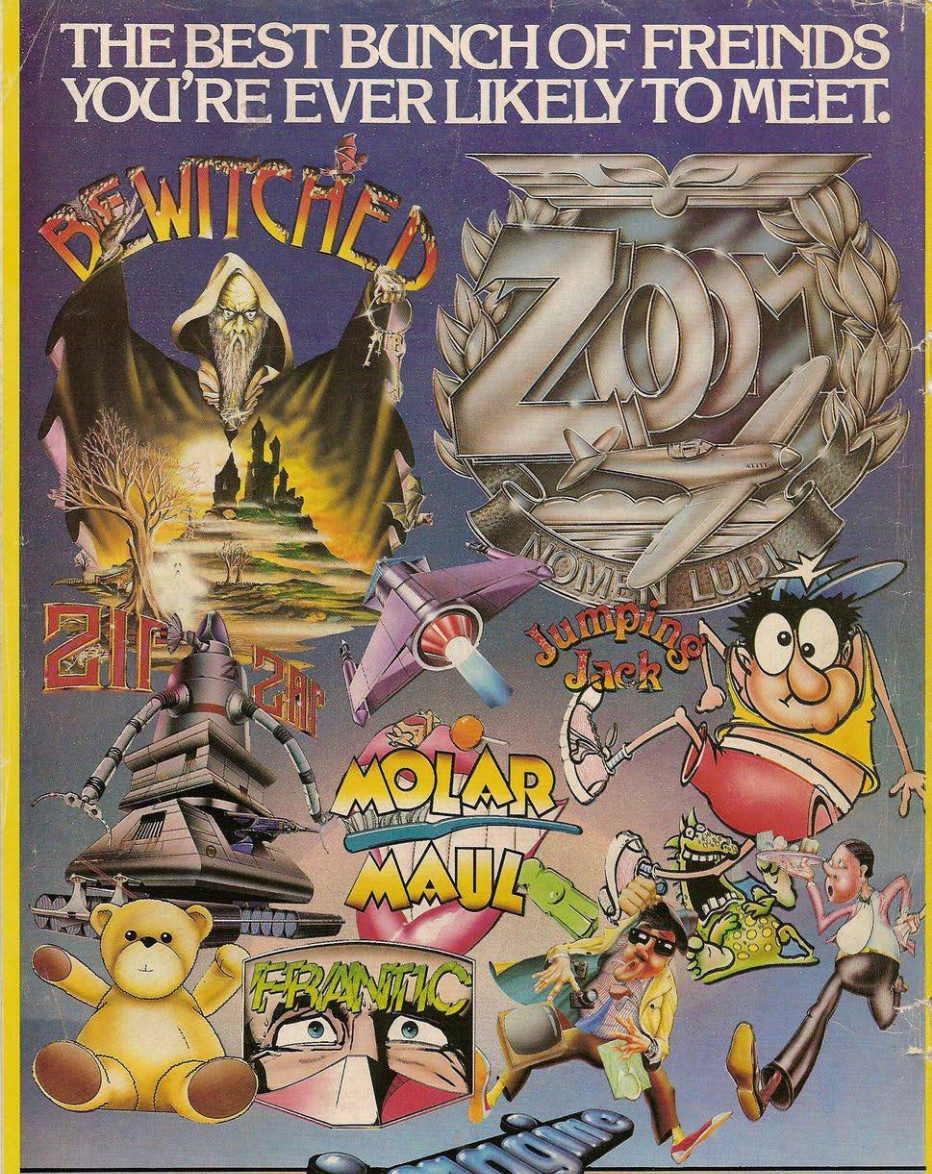

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